UNIVERSITY OF MICHIGAN
FEB 17 1959
FORESTRY LIBRARY

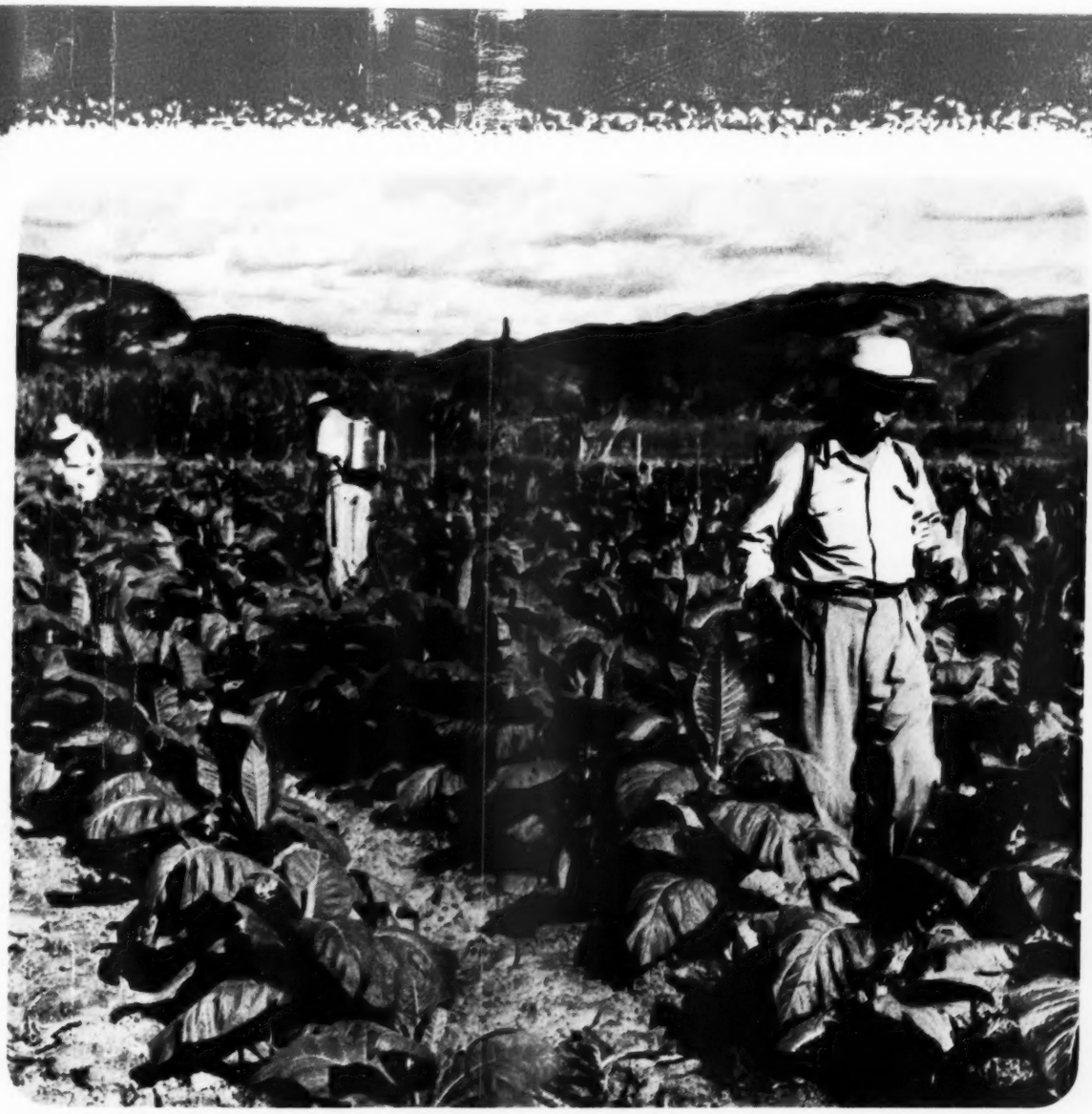
Pest Control

WORLD CROPS

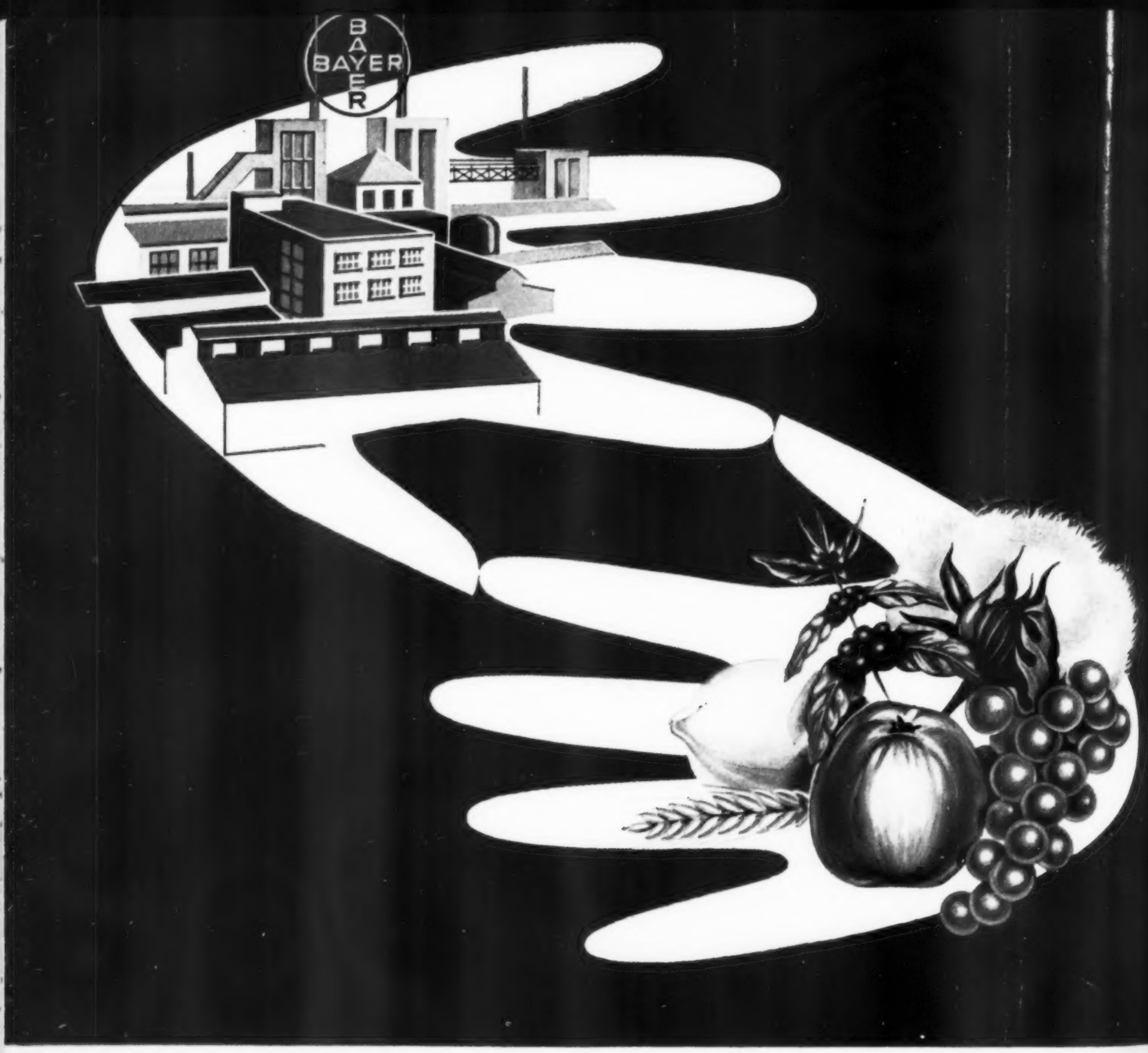
The International Journal of Agriculture

VOLUME 11, No. 2 FEBRUARY 1959

A Publication of The Leonard Hill Technical Group



Spraying tobacco plants in Venezuela with the Shell experimental insecticide WL50 to protect against Heliothis virescens F. (A Shell Photograph)



Give and Take

In these times of specialization and allocation of work tasks, the individual can no longer exist on his own; everyone of us is dependent upon the other. This applies in private spheres just as much as it does in politics and in trade.

All over the world, men are hard at work yielding from the soil foodstuffs and raw materials for clothing to satisfy the requirements of millions of people. Our large cities and towns could not survive for a single day without these vital goods supplied in an incessant stream from our fields and plantations. But when we learn that in the progressive agricultural regions of the world today a single man's work yields sufficient produce to feed almost twenty others it must be realised that this is due to the aid rendered to farmers by science and engineering. It is only by the introduction of man-made mineral fertilizers, work-saving machinery and last but not least agricultural chemicals (insecticides, fungicides, weedkillers etc.) developed by the chemical industry and proved in field trials, that soil yields could sufficienty be increased to prevent starvation in the world.

Farbenfabriken Bayer agricultural chemicals, by virtue of their very high quality and reliability, are rightly popular with farmers and growers, and are widely used to protect crops against losses caused by attacks of fungous diseases and insect pests.

The chemists, biologists and technicians of Farbenfabriken Bayer have succeeded in developing highly effective products for use against plant diseases and insect pests:

Ceresan – seed dressing

Cupravit – copper spray

Pomarsol – TMTD spray

Folidol, E 605
methyl parathion, ethyl parathion

Metasystox, Systox – systemic insecticides

Dipterex, Gusathion, Chlorthion
new type insecticides

Hedonal – herbicide

Tugon – fly killer

FARBENFABRIKEN BAYER AKTIENGESELLSCHAFT LEVERKUSEN (GERMANY)

Represented by agencies in all countries of the world

CONTENTS

Editoral Comment:
High Optimism; Research in Tropical Agriculture; A New Concept; Pest Outbreaks; Highlights of the Weed Conference; Extension Work Overseas; The Drift Problem; Self-Criticism; Nectar of the Gods; Nematodes; Plant Nutrition and Shade; Standing Room Only 43

Protection Against Termites—*W. V. Harris*, M.SC., M.I.BIOL. 47

Potato Blight—*A. V. Coombs and H. S. Foster* 51

Aerial Spraying—*Wg. Cdr. P. R. Hatfield* 53

The Regeneration of Old Coffee Estates—*A. E. Haarer*, F.L.S. 55

Pests and Diseases of Timber 58

New Palms for Old—*Redvers Hains* 60

Mealy Bugs 61

Lime for Coconuts—*G. Middleton* 62

Operation Termite—*P. G. M. Lee* 63

Couch Control 65

Weeds in Temperate Regions: I 66

Weed Control in the Tropics: III 68

New Technique for Locust Control 69

New Publications 71

Machinery and Equipment 73

Agricultural Chemicals 77

World Crop Reports 79

Editor: Frank Cooke, A.R.C.S., B.SC., A.M.I.CHEM.E., E.D.

A publication of the Leonard Hill Technical Group. ENGLAND: *Leonard Hill House, Eden Street, London, N.W.1* (*Euston* 5911). U.S.A.: 92 *Lorraine Avenue, Upper Montclair, New Jersey* (*Plaza* 5-1127, *Pilgrim* 4-2484); 222 *N. Wells Street, Chicago* 6, *Illinois* (*STate* 2-5251); 1900 *Euclid Building, Room* 225, *Cleveland* 15, *Ohio* (*CHerry* 1-7565); 1214 *Villa Drive N.E., Atlanta* 6, *Georgia* (*Trinity* 2-2969); 2515 *Beverly Boulevard, Los Angeles* 57, *California* (*DUnkirk* 1-2241); 681 *Market Street, San Francisco* 5, *California* (*Exbrook* 2-2612); 121 *Ward Parkway, Kansas City, Missouri* (*Logan* 1-3880). ITALY: *Via Filippo Turati* 3, *Palazzo Giardino, Milan* (639367). SWITZERLAND: *Luzernstrasse Kussnach a.R.* FRANCE: 63 *ave. Kleber, Paris XVIe* (*Passy* 31-30). SWEDEN: *Tunnelgate* 19*b*, *Stockholm.*

Subscription rates: 1 year £2; 3 years £5; Dollar rates: 1 year $12.00; 3 years $30.00 post free.

© *Leonard Hill Limited.*

LEO-COLIBRI

for Spraying or Dusting

Tea - Coffee - Cotton
Rubber - Fruit and
all Crops

There is a suitable machine in our wide range for IMMEDIATE DELIVERY

Output:
3 — 525 gallons per hour

Tank Capacities:
3½ pints — 176 gallons

Pressure:
25 — 570 lb. per square inch

Fully illustrated Catalogue from

COOPER, PEGLER & CO. LTD.
P.O. BOX 9-307
BURGESS HILL, SUSSEX

HYPERMICROVER

TOXAVER

VITIVER Charging FAVORI-COLIBRI

Stop seed-borne diseases now

'AGROSAN' 5W is a very special Plant Protection product. It is the sworn foe of seed-borne diseases. It disinfects cereal, cotton and flax seed in two ways—adhering to the seed and killing all outside fungal spores, and penetrating to kill all hidden fungal spores. This double-action of 'Agrosan' 5W is highly effective in protecting your crops.

If you have not used 'Agrosan' 5W, try it without delay. It combats diseases of wheat, barley, oats, rye, sorghum, rice, flax, cotton and sugar cane. If you don't know how to apply it—ask us or your nearest Plant Protection agent.

Call in Plant Protection and...

'Agrosan' 5W

Specific remedies for crop diseases, pests or weeds.
Consult your local Plant Protection agent or write to us direct about well-tried and effective Plant Protection products under the following groupings:—
Selective and total weedkillers
Copper and thiocarbamate fungicides
Phosphorus and hydro-carbon insecticides
Mercury and thiram seed dressings with or without lindane.

PLANT PROTECTION LTD 61, Curzon St., London W.1
A subsidiary of Imperial Chemical Industries Ltd

Editorial Comment

High optimism

ADDRESSING A joint meeting of the Commercial Chemical Development Association and the National Agricultural Chemical Association of America, the Secretary of State, Ezra Taft Benson, said: 'This is an age of marvels – the chemical age of agriculture . . . but it is only just beginning. By 1975 the market for agricultural chemicals is expected to reach $3\frac{1}{4}$ billion dollars a year – one billion on pesticides ; $2\frac{1}{4}$ billion for fertilisers'. (Over £1 billion.)

He urged more emphasis on basic agricultural research to provide further insight into the processes of nature to determine, for instance, how insects build resistance to chemicals, or how soil structure affects the intake of water and fertiliser by the plant. Some of the ablest scientists of U.S.D.A. have been assigned to work in 'pioneering' laboratories, where science goes deep into the unknown. 'This increased emphasis on basic research is vital', he said, 'for science has entered a new fast-moving stage of progress'.

Fourteen of these 'pioneering' laboratories have been set up at Beltsville, Maryland, and more are to follow. In addition, six research laboratories for utilisation and development work are being established in various parts of the U.S.A. The 'pioneering' laboratories will study such problems as how allergic responses are produced, or how chemical substances help plant cells to perform their life processes.

This is an example of the high optimism that pervades American thought. It involves a tremendous investment in research to preserve the economic balance of the nation, so that the nation can go ahead simultaneously on all economic fronts. The lesson has also been well learned in Britain that money spent on research by truly dedicated workers is money well spent, and if the nation or an individual business is to progress and hold its position today, research must be the last thing on which to retrench.

Research in tropical agriculture

ADDRESSING THE Uganda Agricultural Association on the objectives of research in tropical agriculture, Sir Joseph Hutchinson contrasted the original research policy of the Imperial Department of Agriculture in the West Indies with that formulated about the same time by the Imperial Department of Agriculture in India. Operating under a scientist by training and outlook, the former set a standard of investigation and advice that provided the basis for the existing agricultural systems in that region. The breeding of sugar cane from seed was worked out and the potentialities of better factory procedure demonstrated. The sugar industry was still alive and active 30 years or more after its obituary had been written by a Royal Commission. Under the stimulus of men like Sir Francis Watts and G. A. Jones, both field and factory methods were changed out of all recognition. Furthermore, the Sea Island cotton industry was established and the various hazards to which this crop is subject overcome as a result of scientific enterprise and imagination.

By contrast, the Indian Department was directed by excellent and public-spirited senior servants who, because they lacked scientific training, judged the work of their subordinates by the sole criterion they understood; that is, its immediate applicability to the improvement of Indian farming. Long-range work – the pursuit of knowledge with only an incidental interest in its application – was done, but received no encouragement, and the results frequently remained unpublished. India has indeed moved far from this state of mind, but this attitude persisted for many years. It was concern with the amelioration of things as they were that so handicapped the Imperial Department in India; it was the complete inadequacy of things as they were in the West Indies that induced its Imperial Department to consider the things that might be achieved.

A new concept

Applying these concepts of long-term agricultural research to the problems in Uganda, Sir Joseph remarked that experimentalists have been excessively concerned with experiments to the detriment of understanding the agriculture on which they were based. As a result, much has been learned about the components of local agriculture, but nothing like enough about the enterprise as a whole. Concentration should now be on farm planning to give a better living to farmers. The experimental station should be able to demonstrate the economical operation of a farming system, but the profit motive must be excluded, for no experiment station ever produced both information and profits, and the object of the experiment station is to produce information.

No distinction should be made between long-term and short-term research; they are part of the same thing, and their artificial separation serves no purpose save to make a short-sighted policy look meritorious. The objectives must be long-term, the short-term finding and the immediate application being incidental to the work and not the main issue.

We believe that the work in many departments of agriculture has suffered by the narrow and frustrating conception of research policy, such as Sir Joseph Hutchinson describes. Policy, however, is not always

entirely in the hands of the Director of Agriculture. In modern government the director may be the adviser to and servant of a Minister of Agriculture, who is usually not a scientist, but a politician. The Minister's duty is to formulate a policy upon which the director must act. It requires little imagination to conceive the conflict of approach to agricultural policy between a scientist of strong views on long-term research and a Minister with equally strong views and the narrower vision of political expediency.

Pest outbreaks

OUT OF a total of perhaps ¾ million species of known insects and mites, about 5,000 have been designated as pests at one time or another, but it is doubtful whether more than 250 of these have ever reached the level of importance of the locust in Africa or the cotton boll weevil in America.

It may be asked: How do insects achieve pest status? This subject involves the laws of inheritance, population dynamics and ecology. A theory of animal population growth and decline is now beginning to take form, indicating that in nature a species is checked by one or more controlling factors, including climate, weather, natural enemies, food supply and shelter. Chance plays an important part in control and it is seldom that one factor alone is wholly responsible.

Every species has an area in which it can survive and the optimal conditions for survival occur only in a restricted range. A species is usually sufficiently genetically heterogeneous to enable it to survive weather extremes within its distribution range. In the correct climatic environment serious outbreaks or rapid multiplication are likely where food supplies are adequate, there are suitable places for living and there is an absence of natural enemies.

There may have existed some 500 million species on Earth since life began, and today perhaps two million survive; of these, only the exceptional insect manages to achieve pest status because the controlling factors in its environment have been favourable to multiplication.

The question naturally arises: How best can serious pests be reduced to an unimportant level of density? Although there are two ways of controlling insects, either by altering their living conditions or by killing them outright, the routine answer to the problem nowadays is to kill the offending species with one or other of the multitude of chemicals now available.

No one wishes to discourage the use of pesticides, but it is clear that vast quantities are being used indiscriminately with little or no knowledge of the short- or long-term effects. The chemical approach often brings problems as complex as those it sought to solve. Insecticide tolerance and the destruction of the natural enemies or predators by insecticides have today become major problems of entomologists.

So much for the debit side. On the credit side of the use of insecticides the results are staggering. Thus, in the U.S.A. as much cotton is produced today from 15 million acres as was produced from 40 million in 1920, an improvement due in great part to the use of insecticides. It is because entomologists do not want to see such benefits dissipated that the present uneasy feeling towards the indiscriminate use of insecticides has arisen, and a more biological approach is now being urged.

With rapidly increasing world population the large-field system and an extension of monoculture will be essential. Under such conditions pest depredations may well increase so that, sooner or later, biological control may be forced on us. Many years ago in the U.S.A., measures recommended against the cotton boll weevil included the use of early-maturing varieties, close-spacing, forcing the crop and the destruction of trash by the end of October. These were largely ignored and the pest spread throughout the continent till it was in due course halted with the aid of insecticides. But in the American cotton belt it is now recommended that chemical methods of control should always be supplementary to these field practices.

A more biological approach to the problems of pest control is obviously necessary.

Highlights of the weed conference

THESE WERE the three formal lectures given at the Fourth British Weed Control Conference at Brighton by Dr. E. K. Woodford (*A.R.C. Unit of Experimental Agronomy, Oxford*), Mr. R. H. Beatty (*Weed Society of America*) and Mr. E. R. Hattingh (*African Explosives and Chemical Industries Ltd.*). Dr. Woodford drew attention to the lack of qualified advisers on weed control other than those on the staffs of manufacturing firms. 'Chemical weed control', he said, 'is often a very small item in the curriculum of agricultural colleges and university departments of agriculture'. This shortcoming is noticeable, not only in British universities and colleges, but even more so in agricultural colleges in the tropics. This is understandable, but it emphasises the urgent need for consumer education and extension work on an unprecedented and colossal scale.

'Educating the adviser and specialist in weed control must be comparatively easy compared with educating the user of these chemicals. Progress means more and more chemicals and as the number of chemicals increases so each tends to become more specific and limited in its application, for safety is dependent on specificity, and specificity is inversely proportional to demand. Eventually the stage is reached when the average farmer and grower is no longer able to decide for himself which is the correct herbicide for his requirements . . . In the U.K. . . . our intensive mechanised agriculture, combined with the ingenuity of our chemists, has resulted in the position that the cereal grower now has 10 different chemical types and more than 80 approved herbicides from which to choose'.

'At present the farmer relies mainly on the advice of the technical representatives of manufacturing firms, but this is not always sufficient; he often needs advice from impartial

consultants. This could be given by the N.A.A.S., independent consultants, or the specialist advisory services of agricultural merchants. It would be right, I think, for the State to assume more responsibility in the matter . . . '

Extension work overseas

THERE IS also room for much more teaching of the theory and practice of the new science of chemical weed control, particularly in the Central European countries, in South America, in Africa and in Asia. Students are being sent to Europe or America to take expensive courses in botany, agriculture or agricultural research; they are keen to learn and generally do well. They return to their respective countries with high academic honours, but within three or four years they are out of date and out of touch, because they lack the inspiration of scientific competition and personal contact with leaders in the field of weed control.

This view was confirmed by the remarks of Mr. Hattingh, of South Africa, who emphasised the need for much more agricultural education and extension work in that vast continent, where the basic principles of agriculture and the use of fertilisers are unknown and primitive methods are still used on 16 million acres of cultivable land. With the increase in populations there is now a pressing need for a change from subsistence agriculture to cash cropping, he said. The skill of people in tropical countries is less than in temperate climates, and this is an important factor in weed control, which can do so much to increase the productivity of the land, particularly the grazing lands, by the effective control of bush and obnoxious weeds. At the present rate of progress, he estimated, it would be 15 or 20 years before there would be a general demand for herbicides.

This brings us to the important point that we are failing in our responsibilities in not providing effective advisory and extension services to ensure proper continuity in the development of agricultural industries in the newly self-governing countries. The provision of a handful of peripatetic specialist advisers in underdeveloped countries by FAO is not only inadequate, but is largely ineffective. The Colonial Office has a few research specialists on its panel, but not enough, and scientists are reluctant to go overseas nowadays because of the many opportunities at home, and the lack of financial security and fair treatment in the newly self-governing territories.

We assert that scientific progress today is far too fast and we suggest that for every research worker engaged in the field of weed control there should be a hundred scientists engaged on advisory work and education and, further, that for every one field officer in the U.K. there should be 10 on the panels of the Departments of Commonwealth Relations and of the Colonial Office. There is today far too much emphasis on research and not enough on the application of the results of research. In the countries of the erstwhile British Empire, populations are steadily rising and if very serious trouble is to be avoided it will be essential to realise to the full the potential productivity of the cultivable areas, as in 15 or 20 years their populations will have doubled or trebled.

The drift problem

IN AMERICA, according to Mr. Beatty, they have been working on what are called ' invert ' emulsions – the converse of an emulsion. These are viscous formulations of hormone weedkillers of the consistency of mayonnaise which are dispersed by a disk sprayer mounted on an aeroplane or helicopter. These larger droplets fall where intended and do not drift.

Another idea of the same sort is the use of granular herbicides – the hormone being carried in a carrier which makes it a granular product which does not drift. One advantage is that the whole of the chemical reaches the ground where it is required and is not wasted on the foliage of the crop; the disadvantage lies in the greater bulk of material which has to be transported, thus increasing the cost.

Self-criticism

GREAT CREDIT must be given to the U.K. for the progress which has taken place since 1939, said Mr. W. H. Cashmore, Director of the National Institute of Agricultural Engineering, when addressing the Farmers' Club in London recently. Today some 483,000 tractors serve 11 million acres of arable land, giving an acreage of one tractor per 27 acres. The corresponding figures for West Germany, U.S.A., U.S.S.R. and India are 43, 103, 443 and 21,460 respectively, *vide* WORLD CROPS, **10,** 1958, 356.

The number of farm workers, he said, had been reduced by a fifth, and yet the production of food has been increased by 60% since 1939. The efficiency of production, too, compared favourably with other countries; for instance, grain is produced in Britain at the rate of 17 tons per farm worker, whereas the average for Western Europe is 10 tons.

Before the outbreak of the second world war, much of our farm equipment was imported from North America and the Continent; today nearly all Britain's farm machinery is made in Britain, and exports now stand at over £100 million, which makes her the largest exporter of agricultural machinery in the world.

There is, however, no room for complacency, for we live in a world of rapid changes. Mr. Cashmore considered that the present position was not entirely satisfactory and his main criticisms were: (1) mechanisation has not reduced the cost of production; (2) there is a great gulf between the efficient and the less efficient farms; (3) there is no precise information on the economics of mechanising the small farm.

Self-criticism of this sort is a healthy sign. The accent now should be on greater mechanical reliability, improvements in design and the development of new techniques. There are today too many machines which have an excessive number of vulnerable parts which can delay operations while spares are being obtained, and this also means an enormous amount of idle capital locked up in a multiplicity of spare parts which have to be carried by the manufacturer, the agent, the dealer and the farmer himself. Manufacturers, said Mr. Cashmore, should withdraw their less satisfactory machines and tidy up their designs to ensure fewer breakdowns and give cheaper and easier maintenance.

It is fortunate that British manufacturers have concentrated on two or three sizes of tractor with considerable interchangeability of implements. 'There is no evidence', he said, 'that it is an advantage to have a wide range of horse-power and relate the size of the tractor to the acreage of the farm, as this practice has the marked disadvantage of calling for a multiplicity of implements'. Thus, to sum up – there is a need now to eliminate unnecessary implements as well as the less reliable machines.

Nectar of the gods

IN RESPONSE to our appeal in a previous editorial on the subject of honey flavours (WORLD CROPS, 1958, **10,** 354) a Canadian reader has written as follows:

'I have had the opportunity of tasting some honey brought from Greece, which was made from the nectar collected from narcissus flowers. It was quite distinctive in flavour, and as dark in colour as our Canadian maple syrup'.

There is little doubt that honey varies in colour and flavour, according to source, and it seems possible that this could be turned to commercial advantage by marketing honey of unique and exceptional quality, collected from special plants, according to season, under separate brand names. This, of course, could only apply where there are considerable areas under flowers, fruit trees or a continuous stand of flowering forest trees, such as the leatherwood tree of Tasmania.

Nematodes

WRITING IN the *New Yorker*, H. F. Ellis states that he owns as nearly as he can compute 10,365,025,000 head of livestock, based on an enumeration by sampling the soil of a ¼-acre plot of land. He finds this is quite a responsibility, for when he puts his foot down outside his house it presses heavily upon 400 springtails, five-eighths of an earthworm, 1,250 enchytraeids, 7,500 arthropods and 250,000 nematodes or wireworms.

Commenting on these figures, Sir E. John Russell is alleged to have said that 'it may seem strange that the numbers of the free-living nematodes are not larger', and so the author concludes that he cannot possibly have less than 10 million nematodes, each with a muscular aesophagus, in addition to as many as six lips in some species.

This humorous article serves to emphasise to the layman the extent of the problem of the control of nematodes, which do such extensive destruction to the root systems of plants, such as pineapples, tobacco and brassicas, unless they are reduced in numbers and kept under control by fumigating the soil with DD or the new soil fumigant, DBPC, at regular intervals.

Plant nutrition and shade

IN AN interesting communication to *Nature* (1958, **4649,** 1613), D. B. Murray, of the Imperial College of Tropical Agriculture, has drawn attention to work done in Ghana by Cunningham and Lamb, which demonstrated the response of cocoa to fertilisers, both with and without shade. As a result of intensive work carried out in Trinidad, he has developed an interesting theory of the interaction of shade and nutrition in the growth and cropping of young cocoa.

The results show that with light intensities of less than 50% full light, then light is limiting to yield; at more than 50% light, nutrition is the limiting factor to yield. Thus it is impossible to consider the shade or the nutritional requirements of cocoa independently. It might appear that this interaction is of great importance in the agronomy of other tropical crops besides cocoa.

Standing room only

THE DUTY of medicine and pharmacy to regulate control of the production of new lives was stressed by Sir Henry Dale, O.M., in opening the 117th session of the School of Pharmacy of the University of London.

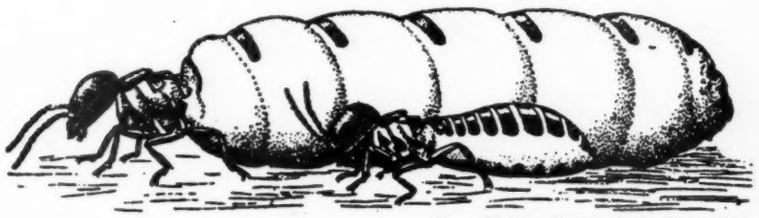
'Nobody', he said, 'will tolerate the idea of preventing the eventual over-population of the world by withholding the ever more effective means for the preservation of post-conceptional lives. That being so, medicine and pharmacy must find some other way of meeting their share of responsibility for the imbalance which they are so efficiently helping to create, and for the ultimate human tragedy which it threatens; and the only way left open to them seems to be an extension of their proper and recognised function to the regulated control of the production of new lives, for the preservation of which, when once they have been produced, they will still be found to use their best available and ever improving knowledge and means'.

This is a fair commentary on the article which appeared in WORLD CROPS (1958, **10,** 435). There is indeed much to be gained by removing this matter of birth control from whatever remains of its furtive associations so that it may be recognised as a most important aspect of the duty of medicine and pharmacy to the already not very distant future of humanity.

Protection Against Termites

W. V. HARRIS, M.SC., M.I.BIOL.
(*Officer-in-charge, Colonial Termite Research Unit*)

A biological account of this pest and a description of its depredations was published in WORLD CROPS (1957, 9, 441 *and* 493).



Illus.: Thomas Cowan & Co. Ltd., Singapore

Termite queen and her consort

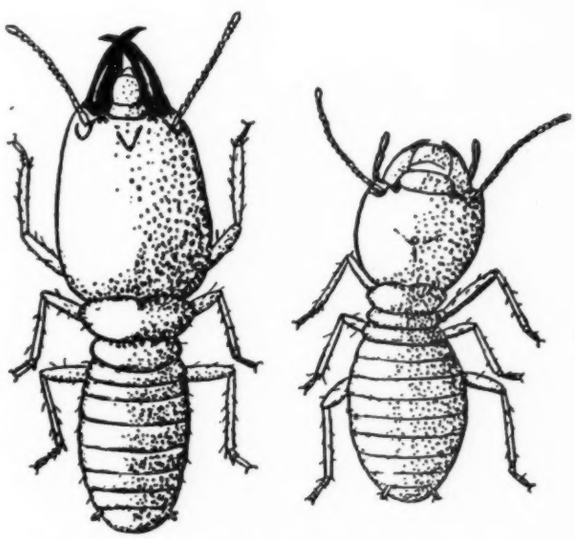
TERMITES are small and usually inconspicuous insects which live together in families and have special non-reproducing castes concerned only with feeding, housing and protecting the community. Superficially they resemble ants, particularly in the tropics, where they build mounds, or 'ant hills', or else dark spherical nests on the sides of trees. Inside these mounds are teeming populations of termites, mainly workers with pale-coloured bodies; a small proportion – about 10% – are soldiers with big heads and sharp jaws, and there are lots of pure white juvenile forms or nymphs, hence the name of 'white ants' which early travellers bestowed on them.

At certain seasons of the year, termite communities spill out into the open air large numbers of winged flying forms, usually about sunset during wet weather. These flying termites are sombre insects with brown bodies and dull or smoky grey wings; they fly in an ungainly manner attracted to any strong light, or just drift with the wind.

Their wings are shed by a kind of quick-release mechanism, as soon as the male and female meet, so that the couple will not be hampered by them in their frantic endeavour to dig a secluded chamber in the soil or in a piece of timber, so that they may escape their many enemies and start a family.

Types of termite

There are no fewer than two thousand different kinds of termites in different parts of the world, but they fall into two distinctive groups – the dry-wood termites, which live in galleries excavated in wood during the course of feeding, and the ground-dwelling termites, which make distinct nests either in rotten wood below ground, or in the soil either below the surface or built up into mounds.



A soldier and a worker ant of Macrotermes *spp.*

Some ground-dwelling termites have adapted their nests for attaching to the trunks of trees far above ground, but there is always a connection with the ground in the form of tubes or covered runways over the tree trunk. There is an exception to this in the case of some ground-dwelling termites which are able to make their nests in ships' timbers below the waterline.

Dry-wood termites, on the other hand, maintain no contact whatever with the ground and move the whole family along, as new galleries are excavated in the search for food.

Sources of food

They feed on wood – on timber, on old stumps and fallen trunks; on the dry butt-ends of branches and wounds in living trees; on fibreboard, chipboard and plywood; on newspapers and books; and on cotton, linen and cellulose acetate fabrics. They prefer sapwood to heartwood and only in rare cases do they attack living trees. However, in Australia there are termites which feed on the heartwood of living trees, causing the loss of valuable timber. In addition, termites will attack without actually feeding on a variety of plastics, such as synthetic rubber and PVC, used as insulation on electric wiring, and will penetrate thin sheet lead in the course of their explorations. Cork insulation for cold stores and cork slabs for flooring are favourite foods.

Geographical distribution

Wherever there is a supply of wood or dry vegetation, and where the winter temperature is not too low, termites may be found. They are especially numerous in the tropics

from sea level to 8,000 ft., in rain forest, grassy plains, cities, and in all but the most barren deserts. In the sub-tropics they are less evident, but the kinds which damage buildings are usually present, and are found around the Mediterranean and Black Sea, and up to La Rochelle on the French Atlantic coast, where the climate is mild. In the U.S.A., buildings are attacked as far north as the Canadian border. In Australia, termites are widespread.

There has been some accidental spreading of injurious termites since the days of the great navigators. Dry-wood termites from the West Indies have been brought to St. Helena and South Africa, for example, and more recently to Madeira. A subterranean termite from the eastern seaboard of the U.S.A. is now established in Hamburg, and in the neighbourhood of Salzburg in Austria.

Dry-wood termites

Dry-wood termites are not infrequently dismissed as ' borers ' and only the ground-dwelling forms recognised as ' white ants '. They will live in timber over $\frac{1}{8}$ in. thick, unless it is heartwood of one of the few naturally resistant woods, such as West Indian mahogany, teak or *Iroko*, or unless the timber has been impregnated with a suitable preservative.

A pair of flying termites arrives and, after shedding their wings, either find a suitable crevice into which they can squeeze or they bore a neat circular hole about $\frac{1}{10}$ in. dia. in the surface of the wood and tunnel in. Thereafter there is no further communication with the outer world until wood-worm-like openings appear on the surface of the woodwork, through which they eject their accumulations of frass.

The little cones of seed-like frass which appear on the floor below infested woodwork are usually the first indications of the presence of dry-wood termites. The holes through which the frass is ejected are soon filled in by the termites and usually escape notice. After some time, when the colony is well established, further ' worm holes ' appear and from these emerge swarms of small dark flying termites, all ready to infest other timbers.

Any form of non-resistant woodwork is liable to harbour dry-wood termites; not only roof trusses, floor beams and window frames, but furniture down to the wooden base of a silver cigarette box and things of that nature. It is not enough that the building is constructed of steel and concrete and similar non-edible materials to ensure that its contents – merchandise, stores or household furniture – will remain free from dry-wood termite attack, if any infested wood or wooden article is brought in.

In the initial stages, dry-wood termite attack is slow, but as the numbers in each separate colony grow, and new colonies are formed by splitting off from the original family, so the tempo of the attack increases, until in the end the infested woodwork collapses under the strain.

Corrugated iron roofs fail to withstand tropical storms when the timbers become weakened by termites; floorboards give way under extra loads; furniture collapses under the heavy visitor; files and card indexes are ruined as the backs of the cabinets fail to support the increased populations feeding in them.

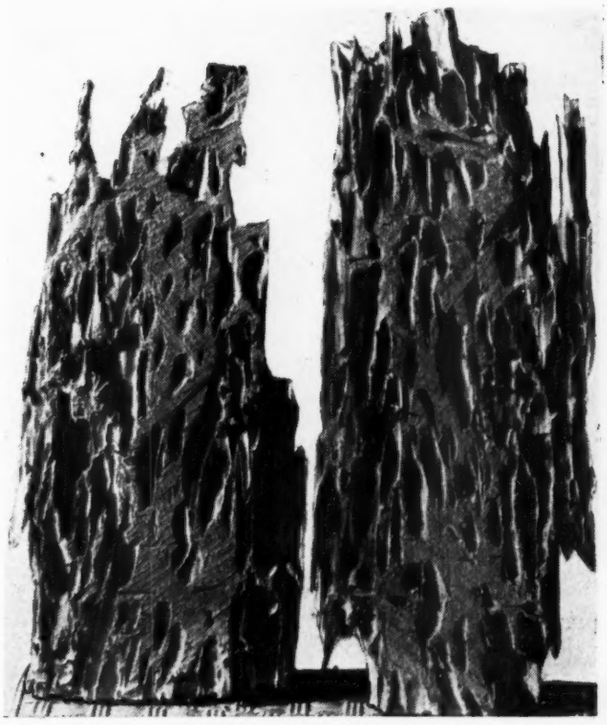
Tanganyika. An apparently sound roof beam of an old building in Dar-es-Salaam, exposed and shown to be hollow and dangerous

Ghana. Covered runways of ground-dwelling termites passing up over the surface of the concrete foundation of a wooden building.

Ground-dwelling termites

Those termites which do live entirely within dry wood all have a definite nest in which the community lives and rears its children, and from which the workers go forth to collect food. Apart from a few exceptions, such nests are either hollowed out in

Left:
Kenya. Damage done by ground-dwelling termites to a fibreboard partition of an unprotected building



Right:
Solomon Islands. Dry-wood termite damage to the softwood panels of an office cupboard, which led to serious damage to files and card indexes

the soil, or in an old tree stump in the soil, or else they are covered with a layer of earth to form a mound.

The workers dig tunnels through the soil and build tube-like covered ways of soil or chewed wood over obstacles so that they can travel to the source of food without exposing themselves to light or dry air, or to their many enemies.

Not only dead wood, but transmission poles, fence posts and all forms of timber in buildings are sources of food for termites, unless they have been made unpalatable either by Nature or by preservatives. In the case of ground-dwelling termites there is another way of preventing termite attack, and this is to isolate the building from the ground by some sort of barrier which will stop the termites.

Damage to buildings by ground-dwelling termites can be of startling rapidity if the new building is near existing termite colonies whose population may be two or three million workers. Once a source of wood has been located by scouting termites, all this force can be ' turned on the job '.

At one time it was customary to have permanent buildings in the tropics supported on masonry or hardwood pillars, with a crawl space below to allow periodical inspection for damage. Nowadays it is fashionable to build flat on the ground, with a concrete slab over the earth fill, and much more woodwork, in the way of parquet floors, skirting boards, built-in cupboards with soft board linings. Thus it will readily be seen why termite damage has increased in recent years.

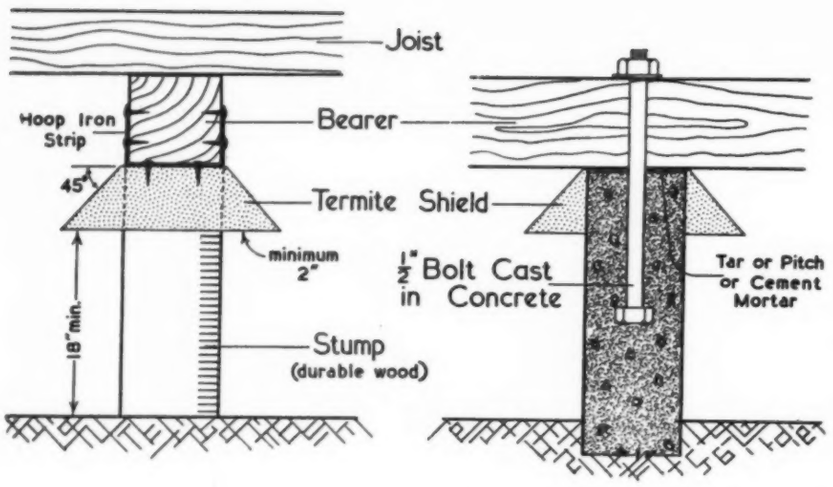
When wood is attacked, it is removed to the nest and the resulting cavities are either filled with earth, or sufficient struts are left in position to support the thin outer layers, which are never removed by the insects. Softwoods and fibreboards are removed faster than hardwoods. Termites will travel 50 or 60 yd. from the nest in search of food, but naturally they prefer to have their food nearer. In practice, damage is more likely to result from nests being enclosed by foundations, or from colonies in the immediate vicinity of the site.

With an efficiently designed and executed barrier, there is no reason why ground-dwelling termites should not be kept out indefinitely. Termites do not eat concrete or well-burnt bricks, but they will penetrate cracks $\frac{1}{10}$ in. wide, and spend years working their way through gaps in imperfect concrete or mortar between bricks, up to second floor level until they come across the ends of rafters. Door frames with their bases set too deep in the concrete slab provide a ready access for termites, while the fibreboard linings of cupboards which have similarly been left without a proper barrier lead the termites quickly up to the ceilings. If forced out into the open, termites will continue their way through earth tubes attached to the brick or stonework, until they find a suitable place to go in again.

Wood preservation

The only way to avoid damage by dry-wood termites, as far as our present knowledge goes, lies in impregnating with wood preservative all woodwork that is not naturally resistant. This method is also practised against ground-dwelling termites in conjunction with, or instead of, mechanical barriers. Generally speaking, it is depth of penetration that counts in wood preservation, providing that due

Nigeria. An untreated telegraph post seriously damaged by the depredations of ground-dwelling termites and ready to fall



Illus.: Commonwealth Exp. Building Stn., Australia

Mechanical barriers in the form of metal shields over the top of a hardwood post (left) *and a concrete post or pillar* (right)

precautions have been taken to protect with additional preservative all cut ends, joints and the like which may have been made subsequent to impregnation.

Among the preservatives which have given satisfactory results against termites are arsenical salts, metallic fluorides, naphthenates and dichromates, pentachlorphenol and its salts, and, of course, creosote. In recent years a variety of chlorinated hydrocarbons have shown good results, though it is usually necessary to include a fungicide in the formulation to provide a complete preservative action. Length of life is an important attribute in a wood preservative.

The choice of a preservative will depend on many factors, such as cost and availability, suitability for the particular timber and the type of processing plant on hand, and the permanence or otherwise of the active chemicals. Pressure impregnation with creosote is a well-tried method of proofing structural timbers, especially where they come in contact with the soil.

Prefabricated joinery work should, if possible, be impregnated after all woodworking processes have been completed, so that the protective layer is complete. Blockboards and plywoods require to have any non-resistant components impregnated. Fabricated boards may have termite repellants incorporated during their manufacture, although they are generally sufficiently absorptive to be treated satisfactorily by dipping. Cork slabs are best treated during manufacture rather than on the job.

In general, it is preferable to have all components impregnated to recognised standards rather than to rely on treatment on site. However, it is not always enough to rely on statements that materials are 'termite proof'; rather they should be accompanied by some warranty of a particular treatment which can, if desired, be checked by analysis.

Where timber must be worked on the site, there must be careful supervision of the treatment of all joints and cut ends, unless, of course, penetration during impregnation has been complete. If this is not done, there is danger of providing termites with ways of access to the inside of the timber.

Mechanical barriers

Mechanical barriers are not regarded as giving absolute protection from attack by ground-dwelling termites in practice, but they do ensure that termite activity is driven to the outside where it can be seen. Thus barriers and regular inspection are complementary precautions. The design of barriers is a technical problem depending to a large extent on the type of building.

Owing to the degree of expansion and contraction of tropical soils in successive dry and wet seasons, it is difficult for foundations and concrete slabs not to develop fine cracks through which termites can quickly gain access to the building. A continuous layer of dense concrete, suitably reinforced and overlapping the sides of the foundations, is one way of ensuring that the termites cannot work their way up inside the walls.

Similar protection can also be achieved by using a continuous strip of non-rusting metal as a termite shield over all foundation walls, including those inside the building. Metal shields are valuable on pillars and posts supporting buildings with a crawl space below. Large slabs, if not reinforced, can be laid with expansion joints filled with termite-proof jointing compounds so that they can give without cracking. Particular thought is necessary in designing foundations for temporary buildings, since a little extra expenditure on metal shields will greatly prolong their useful life.

Chemical barriers

A second type of barrier is that formed by a layer of poisoned soil. The practice is growing of spraying with suitable chemicals the soil on each side of foundations before returning the soil, and of treating the site, when infilling is complete, to provide an impervious layer below the flooring.

This is a worthwhile insurance against attack even when structural measures are being used; it is much easier and cheaper to do when building is going on than later when termites enter the completed building, particularly with concrete slab floors. Soil poisoning is useful for the protection of prefabricated buildings and other structures of a semi-permanent nature, where foundation work is to be kept to a minimum.

Suitable chemicals for soil treatment are usually soluble in water or available in water-miscible emulsions; they include arsenite of soda, sodium pentachlorphenate, and a number of the recently developed chlorinated hydrocarbons.

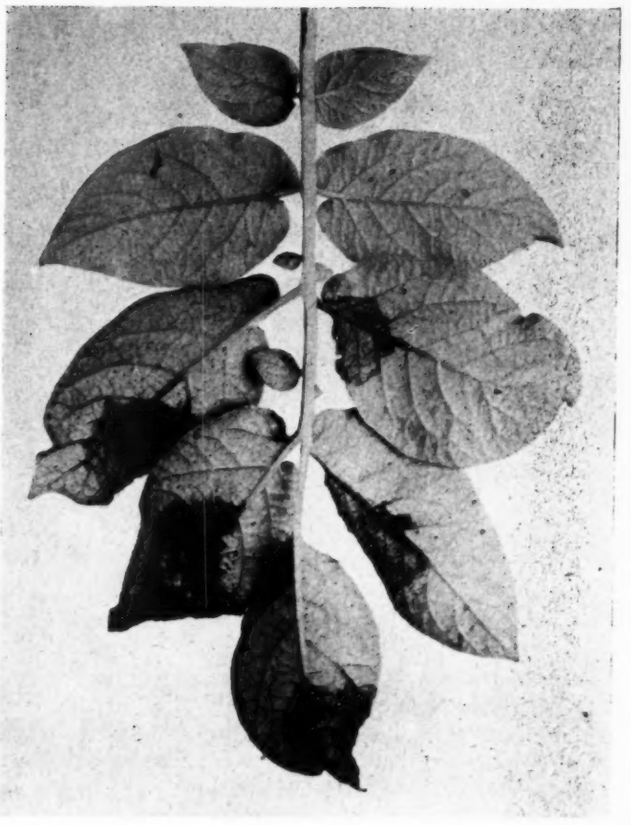
Tractor Championship

The winner of the high-cut tractor class at the Eighth British Ploughing Championships was Mr. J. H. Nott, who used a Ransomes plough, drawn by an International B-250 tractor. In Northern Ireland Mr. W. L. McMillan took the title, using a Fordson tractor fitted with a Ransomes plough. In Holland J. Van Maanen, also using a Ransomes plough, was first.

Potato Blight

A. V. COOMBS AND H. S. FOSTER

The application of Bordeaux and Burgundy mixtures in low volume.



The symptoms of potato blight on the leaves of an affected plant

Photo: Crown Copyright

Min. of Agriculture. By permission of the Controller, H.M.S.O.

POTATO BLIGHT was probably in existence long before potatoes were found by Spanish explorers under cultivation by the Incas of Peru over 400 years ago. The disease did not, however, come into prominence in Europe until 1845, when in a very wet summer it was responsible for the great potato famine in Ireland, which is now an historic event. At that time nothing was known about the disease which was generally regarded as an act of God.

We now know that potato blight is caused by the fungus *Phytopthora infestans*, which, having over-wintered in a tuber, may grow inside the new plant until atmospheric conditions are favourable for its reproduction. It then produces spores which are wafted through the air from plant to plant and from one field to another. We also know that blight on the stem and leaves of a potato plant does not attack the newly formed tuber. Infection is by spores falling either directly on the tubers or by being washed through the soil on to them.

Losses due to blight may therefore be twofold. Firstly, they may be caused by the fungus, particularly when it appears early in the season, prematurely destroying the foliage and thus preventing the full development of the tubers. With healthy growth, potatoes gain about ¾ ton per acre each week in weight of crop; if the haulms are prematurely killed, the tubers cease to grow, resulting in a serious loss in yield. In the second place, losses may be caused through the production of a large number of diseased tubers, even though the yield may be good, as sometimes happens when blight attacks occur late in the season.

The only known practical method of controlling blight at present consists of preventing healthy plants from becoming infected by air-borne spores, either from primary foci within a field or from neglected plants and fields in the neighbourhood.

In 1891, the Royal Agricultural Society of England conducted the first organised large-scale trials with Bordeaux mixture ever made in Great Britain, since when it has remained the standard remedy for the prevention of blight wherever potatoes are grown to any large extent. How effective this simple, old and tried fungicide is may be gauged by the words of Dr. John Grainger, of the West of Scotland Agricultural College, Auchincruive, who in 1957 wrote[1]:

> ' It (Bordeaux mixture) and its congener, Burgundy mixture, in which washing soda is used instead of lime, still give greater control of blight than any of the other substances tried over the last four years at Auchincruive. These include copper oxide, copper oxychloride, mercurised copper oxychloride, captan and phenyl mercury chloride. Some of these, indeed, gave only half the performance of Bordeaux or Burgundy '.

High-volume spraying

The conventional method of protecting potatoes against blight has still much to commend it. It is to apply a 1% Bordeaux (10 lb. copper sulphate; 12½ lb. hydrated lime and 100 gal. water)* or a 1% Burgundy (10 lb. copper sulphate; 12½ lb. washing soda or 6 lb. soda ash, and 100 gal. water) in high volume at around 120 gal. or more per acre, which ensures the crop getting a drenching spray. The time and frequency of application will depend on the stage of growth of the crop and the weather. If the first application is rightly timed before the blight has had a chance to spread, three sprayings at 14- to 21-day intervals generally suffice to protect the crop adequately against blight.

Low-volume spraying

Attempts at applying concentrated Bordeaux and Burgundy mixtures through the traditional types of low-volume hydraulic sprayers which work on exactly the same principle as the high-volume sprayers, except that they employ a small-orifice in place of a large-orifice nozzle, have generally failed owing to frequent blockages, which has led to the popular misconception that Bordeaux and Burgundy mixtures cannot be applied in high concentration, *i.e.* in small or low volume.

The development of a revolutionary technique of spraying which employs air rather than water to carry the concentrated spray fluid to the crop now

* Technically described as a 10:12½:100 mixture.

Photo: *Farmers Weekly*

A ' Micron Twin ' rotary atomiser, mounted on a Massey-Ferguson ' 35 ' tractor, being used for applying a copper fungicide

makes it possible to apply Bordeaux and Burgundy mixture in ultra-small volume. There are today a number of these ' air-flow ' or ' mist-blower ' types of sprayers on the market which depend on air instead of a small-orifice nozzle to atomise and carry the almost paste-like spray liquid to the crop. Trials with various concentrations of Bordeaux and Burgundy mixtures using a small shoulder-mounted and a large tractor-mounted mist sprayer have been made.

Using a *Motoblo* shoulder-mounted, motorised mist sprayer, consisting of a basic unit with a 2-gal. tank mounted on top, from whence the spray fluid is pressure-fed to the nozzle, where it is injected into a 240-m.p.h. air stream and carried to the crop, it has been possible to apply a Bordeaux mixture containing 3 lb. copper sulphate, 1.2 lb. hydrated lime and 2 gal. water.* With this machine it is possible to obtain an excellent cover on both the upper and under surfaces of the leaves at 4 to 6 gal. per acre. Much the same sort of cover has been obtained using a Burgundy mixture containing 2 lb. copper sulphate, 1.2 lb. soda ash and 2 gal. water.

Last summer one half of a large field of potatoes was sprayed in a trial organised jointly by the National Agricultural Advisory Service and ' The Farmers' Weekly ' with a Bordeaux mixture containing 16 lb. copper sulphate, 11 lb. hydrated lime and 24 gal. water, and the other half with a Burgundy mixture containing 24 lb. copper sulphate, 15 lb. soda ash and 24 gal. water, using in both cases a tractor-drawn *Micron Twin* rotary atomiser sprayer. A feature of this sprayer is that it has a rotating gauze drum through which the spray fluid passes and which breaks it up into minute particles, which are then carried by a strong current of air to form discreet droplets on all surfaces of the crop foliage. This machine gave an excellent cover over a 10/12-row swath when the Bordeaux and Burgundy mixtures were applied at the rate of about 6 gal. per acre, *i.e.* 1 to 1½ lb. copper per acre.

It is possible to apply more concentrated mixtures than those described here, which are merely given to illustrate the great potential these air-flow type of sprayers have for the application of freshly prepared Bordeaux and Burgundy mixtures in low volume.

Aerial spraying

Arising out of work with the *Motoblo* and the *Micron* sprayers, the first known attempts at applying freshly prepared Bordeaux and Burgundy mixtures from the air were made in August 1958, when a fixed-wing aircraft belonging to *Crop Culture (Aerial) Ltd.* and fitted with their standard wing-mounted rotary atomisers successfully applied a 40 : 24 : 40 Burgundy mixture containing 40 lb. copper sulphate, 24 lb. soda ash and 40 gal. water at 4 gal. per acre = 1 lb. copper per acre. This mixture flowed through the rotary atomisers without any trouble and there was no build-up on the mesh. The deposit on the potato plants was good, particularly on the upper surfaces.

Attempts at applying a 40 : 16 : 20 Bordeaux mixture at 2 gal. per acre (also giving 1 lb. Cu per acre) were not so successful with the existing fine-mesh rotary atomisers. With slight modifications to the spraying apparatus, however, it is hoped to be able to apply this higher concentration, which is about the strongest practicable concentration of copper sulphate, and further work in this direction is now in progress.

REFERENCE

1. Grainger, J.: *The Agricultural Review*, 1957, III, No. 5.

* Technically described as 3 : 1.2 : 2 Bordeaux mixture.

Research on Hop Diseases

Progress in research on hop diseases was reviewed on Members' Day at the East Malling Research Station in Kent, England.

Verticillium wilt, the main subject of the programme, was introduced by A. F. Posnette, head of the Plant Pathology Section. J. F. Wilson described three new wilt - tolerant varieties, ' Density ', ' Defender ' and ' Janus ', that would shortly be available and appeared to be satisfactory for both growers and brewers. The persistence of wilt in tolerant varieties was discussed by P. W. Talboys, who concluded that attempts to eliminate the fungus appeared to offer better prospects of ultimate success than attempting to achieve immunity by breeding. The methods of infectivity, survival and spread of the fungus were outlined by G. W. F. Sewell, who drew attention to the possibilities of eliminating the fungus in the soil by various treatments and the beneficial effect of palliative measures in limiting the spread of infection.

Research on two virus diseases – nettlehead and split leaf blotch – was described by J. T. Legg. It was essential to find out how these diseases were spread before specific control measures could be recommended. None of the usual insects on hops appeared to be involved and Mr. Legg was now exploring such possibilities as leaf-hoppers and soil transmission.

Aerial Spraying

Spraying Against Potato Blight in 1958

WG.CDR. P. R. HATFIELD

According to the Potato Board, floods and blight have reduced the 1958 crop in Britain by about 200,000 tons – roughly 5% less than in 1957 – worth about £5 million. The loss could have been catastrophic but for the steps taken to minimise the damage by spraying with copper fungicides.

THE potato spraying campaign of the company began in the middle of March and took the form of a series of demonstrations to prove to farmers that this new technique really is effective. The weather at that time of year is normally not ideal for spraying and, in fact, they had to contend with high winds and rain, which proved to be only a foretaste of the atrocious weather that followed almost throughout the summer.

Farmers who attended these demonstrations were favourably impressed by the cover obtained on the potted geranium plants 'shivering' in the middle of the demonstration plots, and a lively interest was apparent. The object was to get them to place firm orders, so that an orderly campaign, moving from one area to another, could be planned. Many did actually agree to have their potatoes sprayed from the air, but in an effort to avoid unnecessarily early sprays they would not commit themselves to definite dates. Only a few wise virgins had their prophylactic spraying completed before the blight showed itself. Then, as had been feared, everybody, everywhere, wanted their crops to be sprayed at the same time.

Types of aircraft

A number of different types of aircraft were used, firstly and principally the 'Tiger Moth', fitted with rotary atomisers at the wing tips. This sturdy, well-tried, simply-constructed and highly-manoeuvrable aircraft has been the pioneer of aerial spraying in Britain. The rotary atomisers feed a very fine droplet size spray into the biplane down-wash, directing a thick, gently swirling mist into the foliage.

The 'Jackaroo' is an improved version of the 'Tiger Moth'; its chief advantages are that it can carry a slightly larger load – two people with the spray tank in position, and four people without it. This means that the ground-marker can also travel in the aircraft, a distinct advantage when moving from one site to another and when spraying time is short. Aircraft fitted with spray-booms, which were pressed into service, were nothing like as effective as the rotary atomisers, chiefly because of the larger droplet size reducing the effectiveness of the cover.

Operations in England

It is of the utmost importance to utilise to the full every minute of suitable spraying weather, but for every hour flown it is estimated that only about 15 minutes are actually spent in spraying. It must, therefore, be every operator's aim to cut down ferrying between sites and reduce flying time to and from the airstrip to the crop, particularly when the weather has seriously interfered with the programme. A quick turn-round, *i.e.* reload and refuel, is also essential. Fortunately in England, particularly in East Anglia, there are a large number of disused airfields, and one can generally be found close enough to ensure reasonably short trips to the crops. An aircraft that can use a farm field with only a few hundred yards take-off run will greatly reduce the non-productive flying time incurred, when all flights have to be made from an airfield.

Weather conditions required are a wind speed of not more than five knots* and freedom from heavy rain for two to four hours before and two to four hours after spraying. Light rain, drizzle and dew do not affect very low-volume aerial spraying as much as they do high-volume ground sprays. However, with the unbelievably long spells of wet weather experienced last summer, good spraying conditions

A spraying demonstration before a group of farmers in Brtiain before the outbreak. The 'Jackaroo', fitted with wing-tip rotary atomisers, approaching the plot

*Five knots: 6 m.p.h. (approx.)

were rare and, for the same reason, the wet land was unfit for ground sprayers, so adding to the demand for aerial work.

Further to these difficulties there were, of course, mishaps to aircraft due largely to the wet conditions, which reduced the aerial spraying capacity, but everywhere the threat of widespread attacks of blight, which threatened to deplete the harvest, was met by enthusiastic efforts to beat it. Senior directors of a well-known chemical firm were up at 3.30 in the morning to catch the calm weather; they helped to man ground radio sets and with the refuelling or marking. In one area one director, who was a private pilot, took a hand with the actual flying. Irrespective of whether they grew potatoes or not, farmers freely loaned suitable fields for use as landing strips and the R.A.F. also characteristically gave every assistance they could – and cheerfully handled the unusual aircraft outside their normal working hours.

The two chemicals mainly used were a colloidal copper or a zineb, both applied in 2 gal. of water to the acre. Where this was applied early enough, a marked resistance to blight was apparent – in some treated fields two to three weeks' growing time was thus added. The cover obtained was very satisfactory, although generally those patches near high trees or other obstacles, which made it difficult to get in, were first affected – even then the major part of the crop continued to show extended resistance.

A highly manoeuvrable 'Tiger Moth' flying low and turning away from a headland to make a fresh run over a potato field in Scotland

Operations in Scotland

In Scotland it was a similar story, except that growers are rather more apprehensive about blight, as their crops are grown almost entirely for seed. Once blight appears, the farmers' immediate reaction is to burn off. It is therefore most important that regular and early prophylactic spraying should be done, but the Scottish farmer is also just as anxious to save himself from unnecessary expense by spraying too soon, and so the inevitable rush occurred here too.

The onset of blight in Scotland was much later than in England, due to the lower temperatures – but when it did come the periods of rainy weather were even more long and continuous and opportunities for spraying were correspondingly less. However, growers who had applied early sprays escaped almost untouched with their crops sufficiently advanced to burn down as soon as the blight did appear without appreciably reducing the yield.

Many Scottish potato fields are on steep hillsides, which greatly adds to the difficulty of getting a tractor on the land in wet weather. Hilly terrain adds to the difficulty of aerial spraying, not because of the steepness of the slopes, but because the sharply rising land in the vicinity restricts freedom of manoeuvre. The steepest of hills can be sprayed from the air if the aircraft can approach and spray along the contours.

However, when the potato field is ringed with hills and is also criss-crossed with high-tension cables, even the aircraft has to give up. Unfortunately, the Scottish Electricity Authority seems to have had free reign and pylons and high-tension cables are found in the most unlikely places in great profusion, which severely restricts aerial spraying activities. Because of the hilly terrain there is also a shortage of suitable fields for landing strips, which results in a good deal more unproductive flying than in England – and, of course, there is always Scotch mist.

Summing up

From the foregoing it will be seen that the only proper course to follow to combat blight effectively is early and regular prophylactic spraying. The spraying aircraft must make the optimum use of good spraying weather by reducing ferrying time between sites, reducing turn-round time and cutting out the need for long trips to and from the crops. This can only be achieved by sound planning of the operations and movements, and by finding landing strips close to the spraying area. Each year adds to the list of fields suitable for use as airstrips and consequently the efficiency of operations improves, so that more acres per hour of good weather can be sprayed with a consequent increase in the portion of the crop saved from blight, and bigger and better yields of potatoes will thus be obtained.

Photos: Airspray (Colchester) Ltd.

Technical News

Articles in the February issue of some of the other journals of the Leonard Hill Technical Group include the following:

Chemical & Process Engineering. – 'Review of Mixing Machinery'.

Corrosion Technology. – 'Pipeline Protection in the Middle East – II' by L. R. Sparrow, B.SC.(ENG.).

Dairy Engineering. – 'Instrument Control for Dairy Automation – I' by G. B. Beattie; 'Instruments for the Dairy Industry – A Guide and Survey'; 'Transport of Milk by Road – III – Buying a Second-hand Vehicle' by E. H. B. Palmer.

Fibres. – 'Cotton – the Supremely Useful Fibre – II'.

Food Manufacture. – 'Technology of Smoked Foods' by W. W. Foster; 'Annual Review – Meat' by F. J. Mallion.

Manufacturing Chemist. – 'The African Species of Rauwolfia' (a shrub yielding an alkaloid used in tranquillisers); 'Analysis of MCPA – a weed-killer'.

Paint Manufacture. – 'Behaviour of Paints in Tropical Climates'; 'Paint Industry in the Scandinavian Countries'; 'Hazards in Paint Factories'.

Petroleum. – 'Solid Petroleum Hydrocarbons and their Effect on Wax Properties'.

Specimen copies of the above journals are available on application to Leonard Hill House., Eden St., N.W.1.

The Regeneration of Old Coffee Estates

A. E. HAARER, F.L.S.*

IT has been said in South America that a coffee estate may come to the end of its economic life at the age of 15 to 18 years – it has been proved in East Africa that 15-year-old trees, properly grown and managed throughout their lives, yield more heavily and are more valuable than younger trees. On the Sesse Islands of Lake Victoria, 100-year-old robusta coffee is still healthy and bearing heavily. When, then, does coffee become too old to bear economic crops. and what are the reasons for failure?

A short life may be due to bad planting in the beginning, and a plantation may become uneconomic for this reason or because pests (such as borer beetle) and bad management have caused the death of trees and hence too many gaps. Gaps in a plantation are the chief cause of a lowering of the average yield per acre.

Replanting and the regeneration of a coffee plantation makes it possible to introduce modern methods, such as contour planting, the provision of a new and better strain of seed, and modern cultural practices which will build up the strength of the young trees in their early years before they bear fruit, to arrive at a stamina and sturdy growth which will be reflected in increased yields throughout the life of the new plantation – as research has shown again and yet again.

The replanting of an old coffee estate provides an opportunity for replanning the property, rejuvenating the soil and introducing modern methods – better seed, contour planting, terracing and inter-planting with grass.

Clearing the land

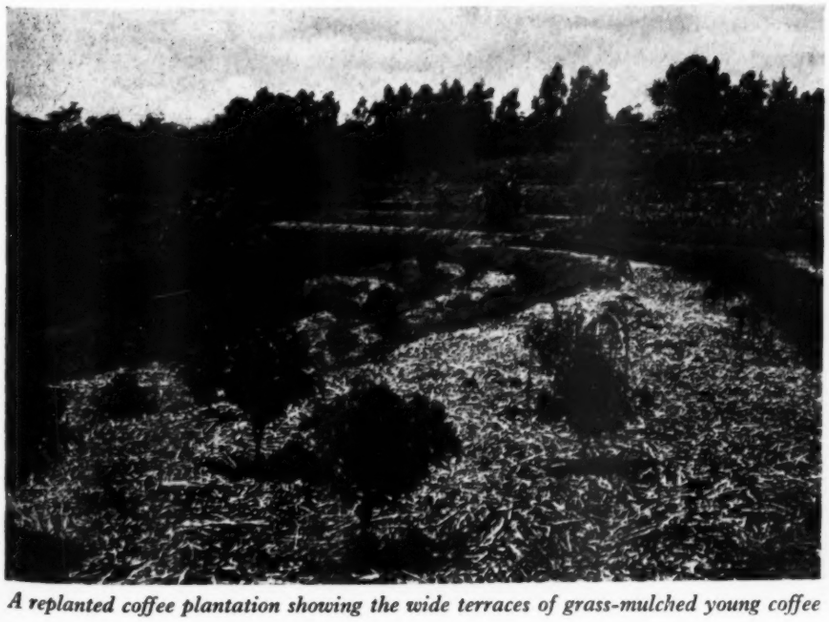
To begin with the old plantation must be uprooted and cleared, not only of coffee, but of shade trees as well, if these have been planted, because young coffee trees will not bear the root competition from the older trees in their vicinity, and they also require plenty of light in their early years. Clearing should be done immediately the last crop has been harvested, so that the soil is clean and cultivated in time for the next rains.

A tractor and chains will normally pull out coffee, and a monkey-winch or tractor winch may be used on the shade trees, so that the work is done without too much disturbance of the soil. Care must be taken to see that no stumps or sizable roots, which will not decay within a few months, are left in the ground or they will become sources of root diseases. Any timber that is of use should be carried right off the coffee land and the remainder – the branches, twigs and leaves – stacked in *small* heaps and burned. Large fires are harmful to the soil; the ashes of small fires must be scattered afterwards as evenly as possible.

Replanning

Having cleared the land, the next task is to carry out any major works concerning the resiting, or reconstruction of drainage and roads, and to consider what may be necessary regarding the pegging out of contour trace-lines and the construction of contour ridges to check erosion. If the land is gently sloping, such contour ridges should be set wide apart. In any case, they would be low and broad and could well serve as roads.

Contour working should be the aim of everyone, and there is no reason why an orchard crop like coffee should not be strip-cultivated along the curving contours of the land, just as herbaceous crops and cereals are treated in modern farming.



A replanted coffee plantation showing the wide terraces of grass-mulched young coffee

Soil regeneration

By this time the next rains should be approaching and it is time to think about the soil, which, for long years, has only been surface-cultivated and has doubtless deteriorated in fertility. It is at this stage that many an owner will be too hasty to replant his coffee on what might well be described as an almost worn-out soil.

Rest and proper treatment are imperative, even though a coffee-planting season may be lost, and, since no one usually has enough farmyard manure or prepared compost to give an adequate dressing to enrich the soil, other means must be adopted to attain the same object. Chemical fertilisers

* Author of *Modern Coffee Production*, Leonard Hill Ltd., 1956, pp. 467, illus., price 56*s*.

are all very well for other purposes, and at other times, perhaps, but they will not under any circumstances give a ' good heart ' to a ' tired ' soil.

The soil needs aerating, oxidising or sweetening – call it what you will – and at the same time its organic content must be enriched at depth. Deep ploughing along the contours or subsoiling where possible, the cultivation of two successive green manure crops, such as cow-peas, and the ploughing of these well in before next coffee planting time, supplies the answer. The opportunity must also be taken to eradicate all noxious weeds, such as couch grass.

Replanting

Meanwhile, coffee seed of an approved and selected strain, which has proved itself ecologically suited to the environment, should be sown in nursery beds, using modern treatments of mulching, spacing and low shade. Then the land should be staked and holed in readiness for planting.

It is now submitted that square planting or spacing should be relegated to the past as a nice and tidy but old-fashioned practice, because it is far better to plant rows curving with the contours – the rows the requisite distance apart, and the trees appropriately spaced in the rows.

Furthermore, it is suggested that down the slope of the land the new coffee plantation should be planted in strips between and parallel to the contour ridges. Supposing 12 rows of trees, planted 9 ft. apart, constitute such a strip, then the strip will occupy a width of land $12 \times 9 = 108$ ft. Alternating with each strip of planted coffee, an equal width of land might wisely be devoted to the cultivation of grass for mulching purposes.

In effect, since it would not be wise to plant grass closer to the coffee than 9 ft., the actual width of grassland would be 99 ft. This strip would be close-planted in rows with cuttings of Napier (elephant) grass, with a space left as a firebreak at each end of a strip.

The value of grass

The grass grown along the contour, or on the contour ridges, could be cut and bundled into sheaves before the seeding stage by simple mechanical means, then withered for a few days before carrying it to the adjacent coffee land on either side. If alternate-row mulching were practised, as has been found advisable, then the grass will be more abundant and so cheaper to produce.

It is to the growing grass, with its closely-matted roots, that chemical fertilisers could be more wisely applied, since, through its more abundant growth and richer mulching, it will maintain the fertility of the coffee land.

Furthermore, the grass strips will hold silt and halt erosion. A surplus of grass will be available for making silage for livestock; and the strips will be there for a second regeneration of the plantation, because the new coffee can then be planted on the grass strips and *vice versa*.

If coffee prices showed a slump, then the coffee strips can be kept on a mere maintenance level, and the grass ploughed for other crops, or it could be used entirely for livestock.

Planting distances

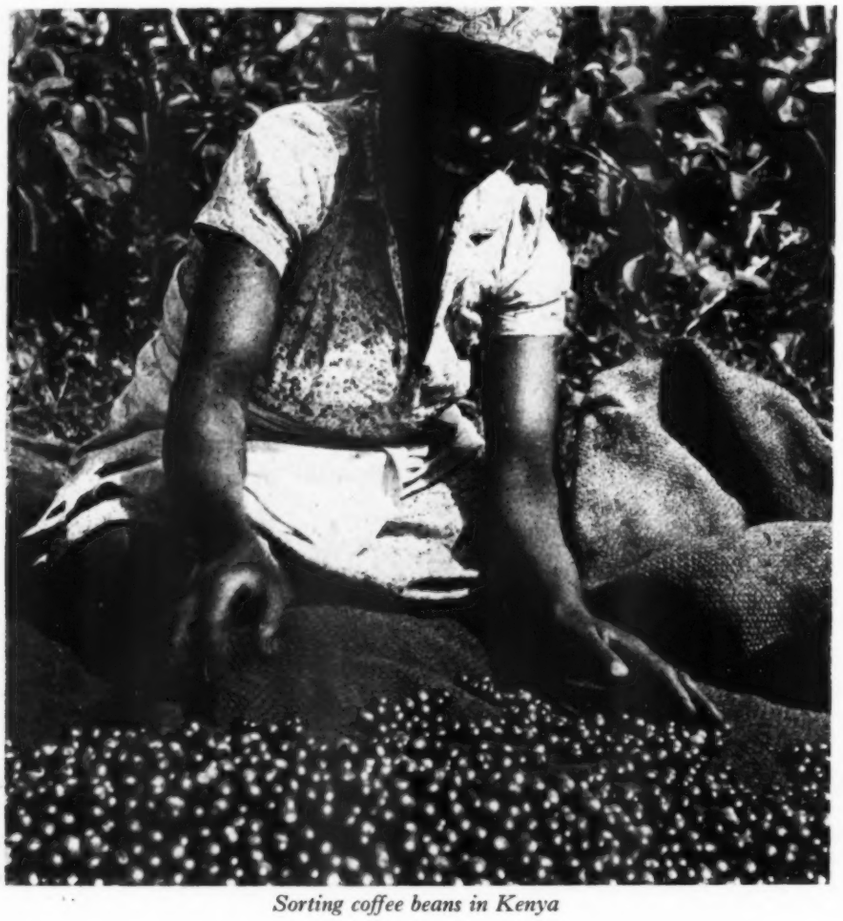
Returning to the question of spacing, this depends on what kind of coffee is planted and the method of pruning. A distance of 9 ft. × 9 ft. is now usual for Arabian coffee, but an experiment carried out some years ago showed that double planting, *i.e.* at half this distance, gave a yield per acre in the first two crop years that showed an economic advantage over a 9-ft. × 9-ft. spacing with alternate rows pruned to single stems.

The danger of double planting, *i.e.* at $4\frac{1}{2}$ ft. × $4\frac{1}{2}$ ft., is that a planter will be tempted to retain this system too long. If double planting is adopted, half the trees will have to be cut out to give the correct 9-ft. × 9-ft. spacing immediately after the second crop has been harvested. There must be no prolongation of the time; furthermore, double planting can only be successful if cultural, mulching and maintenance practices are of the very best.

After double planting, the trees to be cut out should be pruned with a single stem, and those which are to remain developed for the multiple-system method of pruning, if such is desirable.

Planting holes

It has been proved that holing is best done several months before, not



Sorting coffee beans in Kenya

An instructor of the Kenya Agricultural Department pruning a young coffee tree

just before planting, and the planting holes should not be smaller than 18 in. wide by 2 ft. deep. In fact, a somewhat larger hole would be preferable but for the fact that a hole of the dimensions given can be dug mechanically by a tractor-operated post-hole borer.

Proper and careful planting in big enough holes dug some while beforehand will bring bigger yields on the average throughout the life of a plantation. The roots of the young plants must not be planted in the field deeper than they were in the nursery beds, and the least possible shock should be given to the young plants when planting them out in the field.

Many planters, and even agricultural officers, allow coffee plants to remain far too long in the nursery beds, until the plants are crowded, lose their lower and first leaves, develop thin, leggy stems and begin to branch. The writer cannot condemn this practice too severely. A coffee plant needs to be planted out in the field when it has no more than six pairs of leaves.

After-care

It is common knowledge that small young plants live hazardous lives in the field for the first few months. They need to be staked to show their position and carefully watched for any cutworm damage. It is then easier to replace a vacancy and there are means to protect the young plants from cutworms. The extra care given when the plants are young, and the troublesome ' supplying ' that may be necessary, is fully rewarded in later years by the greater stamina and strength of the trees and the absence of gaps. Careful planting and care taken to see that the roots are not broken, bent or twisted will ensure greater yields, more even cropping, and less die-back and disease.

Catch crops should not be cultivated between young coffee. Except for a little temporary shade given by a bent plant frond at planting time, temporary planted shade is unnecessary. It is essential to shade the soil and this can best be done by mulching. Permanent shade is only necessary at lower altitudes where temperatures are high and erratic, and the sun is fierce. In humid temperate regions where the sun is kind, and where there is plenty of mist and cloud, permanent shade should not be necessary. The young plantation will need windbreaks for protection against strong winds.

Photos: Kenya Public Relations Office

Control of Virus Yellows

Yellows threatens the sugar-beet and mangold crops of Britain more seriously this year than at any time since 1949. The most important vector of yellows virus, the green peach-potato aphid, *Myzus persicae*, is prevalent on weeds, on crops and in clamps. Early infection with yellows virus can cause such heavy losses that all possible measures must be taken to prevent the disease.

Much has already been done to decrease the number of sources from which aphids can pick up the virus – by control measures in seed crops and by clearing mangold clamps - but this may not be enough, and a direct attack on the aphids in the root crops may be necessary. Unfavourable weather for aphids during May and June could eliminate this threat, but extensive spraying may be needed to protect root crops from aphids and yellows, if the weather continues to favour their spread. Plans for spraying should therefore be prepared now.

Extensive field experiments carried out during the last few years have proved that spraying sugar-beet crops in June with systemic insecticides can reduce the incidence of virus yellows and give an economic yield response, and in Western Europe, too, spraying is now a routine practice.

To control yellows, crops must be sprayed before aphids become prevalent. The right time may be at the end of May on early crops in the south, but will generally be about the middle or end of June. One spraying is usually enough, but a second after two or three weeks may be necessary if the season particularly favours aphids. Spraying is not usually justified after mid-July.

The farmer with a big acreage who wants to take routine precautions should spray when the plants have a leaf spread of about 6 in.

Crops are damaged when black aphids build up on them. This happens later than the time for spraying to control green aphids and yellows. However, spraying early usually prevents black aphids from damaging crops because the early invaders are killed before they have a chance to multiply.

Good results are obtained by spraying with systemic insecticides, the organo-phosphorus ones being the best, but the makers' instructions must be carefully followed because these compounds are poisonous. Sugar factory field staff and N.A.A.S. officers will be able to advise growers.

Pests and Diseases of Timber

An interesting and well-attended meeting was recently arranged by the Pesticides Group of the Society of Chemical Industry to review recent progress in the studies of the pests and diseases of timber. The lectures, given by two leading authorities in this field of work, were under the chairmanship of Dr. E. E. Turtle. It is deeply regretted that the first author, Dr. R. C. Fisher, died suddenly only three days later.

Development in Timber Insect Control, 1927-1958, *by R. C. Fisher (Forest Products Research Laboratory)*

This paper deals with the development of methods of eradication and control of timber insects in this country over the past 30 years. The status of the principal species concerned during that period is discussed. With the greater use of tropical timbers, damage by ambrosia beetles has increased in significance. During the last war neglect of buildings and storage of furniture led to favourable conditions for increase of damage by the common furniture beetle and in more recent years the house longhorn beetle has become a serious pest in localised areas. The status of the death-watch beetle has remained unchanged, whereas *Lyctus* has decreased in importance.

Methods of control consist of prevention and eradication of attack. Whereas prevention may be the only practicable method of control of insects attacking timber in the forest or storage premises, both methods may be achieved in buildings.

Preventive methods by means of chemicals depends on the penetration and permanence of these substances within the wood. Complete penetration of at least the sapwood may be achieved by impregnation under pressure. In this country timber may be obtained impregnated with aqueous solutions of fluor-chrome-arsenate-dinitrophenol, copper-chrome-arsenate or copper dichromate preparations, whilst in Australia and New Zealand diffusion treatments with borax/boric acid solutions are applied to green timber.

Less satisfactory penetration is obtained by dipping methods, by which the more expensive oil solvent preservatives, such as chloronaphthalenes, polychlorophenols and metallic naphthenates are applied.

Contact insecticides are now used as sprays for temporary protection against ambrosia and *Lyctus* beetles, as smokes against common furniture beetles, and in glue lines for the protection of plywood.

Apart from chemical protection, sound construction and maintenance of buildings, general hygiene in timber yards and early detection of wood-borer damage all play an important role in wood preservation.

The formulation of insecticides for the eradication of wood borers has changed little over the past 30 years, apart from the increased use of chlorinated phenols and the addition of contact insecticides. Sufficient penetration to kill larvae within the wood is still a major problem.

Where treatment with a liquid insecticide is impracticable, fumigation may be an alternative. Recently attention has been given to the use of methyl bromide in place of HCN.

Heat sterilisation for the eradication of *Lyctus* has been standard practice for many years and subsequent DDT or BHC spray treatments ensures freedom from attack before manufacture.

More unorthodox methods of control still in the experimental stage include high-frequency and infra-red heating and radiation with gamma rays. The latter may offer possibilities for control of death-watch beetle infestations.

The interest taken in wood-boring insects has greatly increased over the past 30 years, possibly due to increase in extent of damage, as well as the activities of wood preserving and associated industries. With the present-day tendency to reduce dimensions of carcassing timbers and the use of softwoods from immature trees, it is possible that the common furniture beetle and house longhorn beetle could become more important.

Methods of prevention and eradication of wood-boring insects have progressed over the past 30 years, due to fresh information and the work of

Crown Copyright reserved

A rafter of Scotch pine riddled with the common furniture beetle

servicing firms applying modern treatments by greatly improved methods.

Deterioration of Wood by Fungi and its Prevention by Chemical Treatment *by W. P. K. Findlay (Forest Products Research Institute)*

The paper described the various types of breakdown that fungi can bring about in wood and the chemical changes that are involved. Certain micro-fungi, such as *Chaetomium globosum*, long known as destroyers of cellulose textiles, can cause serious damage to timber in contact with the soil or when used as filling in water-cooling towers. These micro-fungi have a peculiar method of attacking the wood, forming tunnels in the thickness of the least lignified parts of the secondary cell wall.

Wood-rotting fungi vary greatly in their susceptibility to chemical poisons, some of the micro-fungi being able to tolerate toxic concentrations in the wood that inhibit the growth of ordinary wood-rotting Basidiomycetes. *Lentinus lepideus* has long been known to tolerate concentrations of creosote that prevent the growth of most fungi and it is therefore the usual cause of decay in poorly creosoted poles and sleepers. Many species of *Poria* are resistant to copper; other fungi, such as *Lenzites trabea*, tolerate moderate amounts of arsenic. Fungi, such as *Polystictus versicolor*, that cause white rots and possess a polyphenol oxidase system, tend to be resistant to phenolic bodies. Certain chemicals, such as compounds of boron, do not show such variations in toxicity to wood-rotting fungi.

In the past little effort has been made to formulate wood preservatives against specific rotting fungi, but it is essential to use a wide spectrum of organisms when carrying out laboratory tests, so as to ensure that the product is effective against the various fungi that may infect the wood in service.

A great difference between plant protection and timber preservation is the time-scale in which it is necessary to think. Chemicals applied for the protection of living plants are expected to last, at most, only for months, whereas wood preservatives are useless unless they last for many years or decades.

For timber that is to be exposed to the weather, preservatives must have a very high resistance to leaching and extremely low volatility. Some of the new water-borne preservatives based on mixtures of copper, arsenic and chrome do achieve a very high degree of fixation and wood impregnated with such preservatives can withstand prolonged exposure to the weather without significant loss of preservative. Highly effective preservatives of this type are now available in many countries under various proprietary names.

Freshly-sawn timber can be effectively protected against discoloration caused by 'sap-staining' fungi and moulds by dipping the boards in a dilute (1 or 2%) solution of sodium pentachlorophenate. The addition of a certain proportion of borax to the dip can lead to economies in the other chemicals.

Under typical conditions some kinds of wood deteriorate rapidly if left as logs on the ground for any length of time before they are sawn up. Storage under water or under a continuous spray of water affords complete protection. Chemical treatments for the protection of logs against insect and fungal infection are now becoming available and if used correctly afford some protection for a limited period.

Photo: Shell

Ghana. Baulks of timber being sprayed with aldrin prior to shipment as a protection against borer beetles

War on Ants

The fire ant has become a serious pest in 10 of the southern states of the U.S.A. This pest, which is unknown in many countries, apparently moved in from South America on a ship which docked at Mobile, Alabama. Since the 1920s, when they arrived, their migration trends have been north, west and east.

The ant, $\frac{1}{4}$ in. long and reddish in colour, gets its name from the burning sensation it causes after biting its victims. Its attacks are not confined to people. The fire ants often attack the young of ground-nesting birds and poultry, and even newborn calves and pigs. They are particular fond of young quail, and will enter the pipped eggs to get them. They may even chase a brooding hen off her nest and eat her chicks.

An all-out attack is being made by aircraft in heavily infested agricultural areas, and by hand application in cities and heavily populated areas. In order to make certain that the insecticide will be placed with the greatest possible accuracy, granules are being used rather than spray formulations. The fight will require several years to complete and may cover some 20 million acres.

'A lovely bunch of coconuts!' A seed nut should be round, bold and heavy and the bunch should be well supported so that the stalk does not kink

New Palms for Old

The Coconut Improvement Scheme in Kenya

REDVERS HAINS

The coconut palm became a commercial crop as the direct result of the growth of the soap and margarine industries in the second half of the 19th century. Thus a very large proportion of the existing palms are between 70 and 80 years of age – well beyond the age of maximum productivity. The rehabilitation, replanting and extension of the coconut areas is now a serious problem in all coconut-producing countries, particularly where the coconut is the leading cash crop, and where it provides food, drink and building materials.

A STUDY of the coconut palm in Kenya shows that it is the most widely grown crop in the Coast Province, to which, in the past, little attention has been paid by the growers who took what it had to offer without much, if any, thought for the future.

Today, the Kenya Government, through its Department of Agriculture, is tackling coconut improvement in the coastal areas systematically on a long-term plan, location by location. The scheme aims at the general improvement of the coconut areas by the elimination of dead, senile and unproductive palms, by gapping and extension with improved seedlings, and by the reduction of undergrowth and pests.

The Scheme

Work was started in 1954 in the coastal districts of Kwale and Kilifi. The improvement takes place in areas of from two to four square miles each annually, with a concentration of staff in each area. Problems in the districts vary. In Kwale, it is one of gapping and extension; in Kilifi, the reverse applies. The palms are too close together and it is a reduction, not an increase, in the palm population that is required to effect improvement.

First of all a survey of coconut *shambas* on the coast is made. Agricultural officers mark the dead and dying palms which are to be removed and destroyed by burning in stacks. They also mark the required spacing of 10 yd. apart for new seedlings, which allows for inter-cultivation with other crops, particularly the cashew nut tree that attracts the magi moto ant which attacks the coreid bug, the pest which is one cause of immature nut-fall.

Coconut nurseries

Meanwhile, coconut nurseries are being established, each consisting of about half to three-quarters of an acre, planted with specially selected nuts. Great care is taken in the selection of these seed nuts. A good seed must not be too big. It must be round, bold and heavy – a roundness which shows that there is good copra inside. These are picked out and planted on raised beds. After eight months' growth and about a fortnight before issue they are regraded to the extent of 40 to 50%, rejected seedlings being immediately destroyed so that they cannot be mistakenly issued. The selected seedlings are sold to the African growers at the rate of 30 cents a seedling as soon as the long rains start, allocations being according to what the survey has revealed; no man whose land has not been surveyed is issued with seedlings.

After-care

Thereafter the Department keeps a vigilant eye on the growers as regular weeding around the plants is important in the early stages of growth, and goats must be kept away so long as there are any leaves within easy reach.

In Kenya, insect pests cause very

A stack of palm trunks being burnt to prevent the breeding of the rhinoceros beetle, Oryctes rhinoceros

considerable damage to coconuts. The main pests are the coreid bug, the rhinoceros beetle and coconut scale. In certain areas the coreid bug is partially controlled by the large red magi moto ant. Full control has not yet been achieved by this means alone and insecticides are being used with some success.

The rhinoceros beetle, a large insect, damages the palm by chewing the unopened leaves surrounding the bud. Control of this pest is by destruction of its breeding sites – dead and dying palms, accumulations of organic matter and so on. Coconut scale is only of minor importance in Kenya, as it is adequately controlled by its natural enemies, ladybirds being a big help.

In these two districts last year 23,306 seedlings were sold, 10,694 palms condemned, 7,804 palms felled, 5,544 palms destroyed and 78,238 seed nuts laid down in the nurseries.

A collection of beetles and grubs found in decaying coconut trunks which should have been burnt

Mealy Bugs

A Menace to Fruit Crops

Mealy bugs on coffee. The helpless pest has an ant attendant which protects it from ladybirds and moves it from plant to plant
Photo: Shell

Ants and mealy bugs, Pseudococcus spp., *are usually found in association on fruit crops, such as pineapples, citrus, guava and vines, because of their mutual dependence.*

THE Argentine ant, *Iridomyrmed orientalis,* is becoming a major to agriculture in certain parts of threat South Africa. Whereas 50 years ago the ant was to be found only in one small area, it has now spread as far as Port Elizabeth and over the whole of the Cape Peninsula, Stellenbosch, Paarl, Hex River, Somerset West, Elgin and other places. They are still spreading quite fast, mainly along railway lines, and when they reach new territories they exterminate the indigenous ant populations.

The Argentine ant feeds mainly on the honeydew which is secreted by aphids, soft-scale insects and mealy bugs. These three all have their natural enemies, more particularly the wasps and the ladybirds, but in feeding on the honeydew the ants prevent the wasps and the ladybird beetles from feeding on the honey-producing pests, or laying their eggs in or near them.

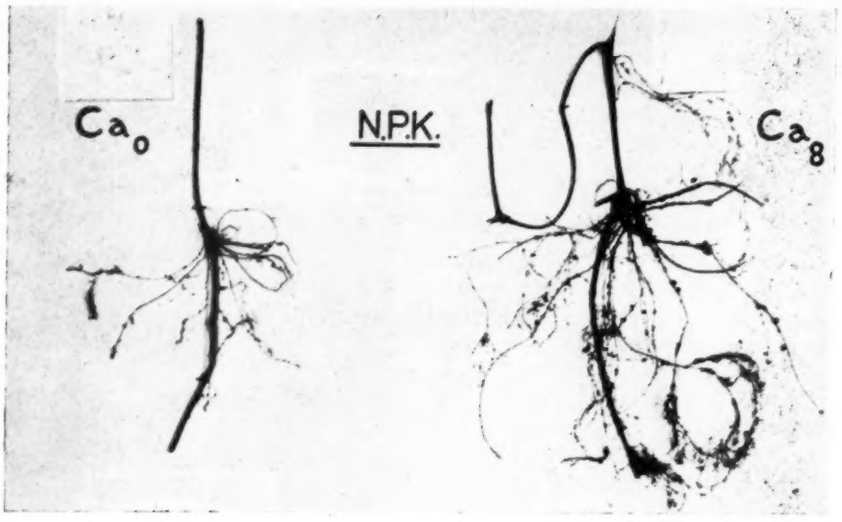
Thus, in effect, the Argentine ant prevents the natural enemies from attacking the mealy bug and either destroying it or at least maintaining a balance in nature. If mealy bug were not controlled, it could result in a reduction of about 5% in overall grape production. To exercise control over the ant the soil in the orchard, vineyard or garden should be treated with either dieldrin or chlordane in the autumn. If this was properly applied, it should prove effective for about three years. But if after the first treatment there was a localised infestation of mealy bug in the vineyard that area should be spot-sprayed with parathion. Any ant-infested vines still remaining should be re-treated by spraying the stems with one of these two insecticides.

Most South African farmers today are using a chemical control on the ants, which automatically leads to the biological control of the mealy bug. Preliminary results of tests now being carried out at the Western Province Fruit Research Station showed that, if ants are controlled either by baiting or by means of insecticides, the biological control of mealy bugs by their predators is possible. It is emphasised that due care is needed in the handling of both dieldrin and chlordane. Thus the ant can now be controlled, but it is from farms which are not treated that the pest, if allowed to remain, can still spread.

Lime for Coconuts

G. MIDDLETON
(*Ceylon*)

For many years it was a popular saying in British farming that 'Lime without manure makes father rich and son poor'. In recent years this hoary old legend has been challenged (see WORLD CROPS, 1958, **10**, 251).



Comparisons of the root systems of plants of the nitrogenous cover crop, Calapagonium mucunoides. *Note the size and number of nodules on the plant from the limed plot* (right). *These are not isolated or selected examples, but are typical*
Photo: C.R.I. (Ceylon)

COCONUTS in Ceylon are grown predominantly on lateritic loams, lateritic gravels and sands. Paltridge[2] has reported the result of multiple pot trials carried out using the grass *Paspalum commersonii* as the indicator plant.

Pot trials

One of his conclusions is:

> While no precise recommendation is possible at this stage, it can be said that both soils (lateritic loam and gravel) would benefit from some addition of calcium, tentatively 5–10 cwt. per acre.

In another series of pot experiments he and Beryl Salmond studied the effect of nutrients on the root system of the legume *Phaseolus lathyroides*, growing in cinnamon sand, and concluded that:

> Where calcium was applied together with major nutrients – N, P and K – there was a definite increase in the number and diameter of lateral roots and there was some differential effect from the two forms of calcium. In the $CaCO_3$ treatments the root systems had a definite tap-root and associated laterals, but in the $Ca(OH)_2$ treatments the tap-root was suppressed and replaced by a number of stout laterals. In the absence of NPK, calcium appeared to have very little effect on root growth.

Large-scale trials

It was decided to apply the results of these small-scale trials on an estate where coconuts were growing on a loamy soil with rock outcrops and lateritic gravel subsoil with the nitrogenous cover, *Calapogonium mucunoides*, to hold moisture, conserve the soil and add to its fertility.

The treatments

The palms in the area where this trial was carried out are 50 years old and up to 1956 they had received 5 lb. per palm of a 3 : 2 : 3 NPK mixture. Following the introduction of the Fertiliser Subsidy Scheme, this was increased to 10 lb. per acre without any apparent improvement in the health or vigour of the palms.

In August 1957 it was decided to try the effect of lime as recommended and to apply in one area 8 cwt. of agricultural lime, containing approximately 70% of calcium hydroxide, and to leave a similar area unlimed, but with the same application of mixed fertiliser.

While it is too early yet to measure the effect in the increase in the yield of coconuts, which takes two years, the effect both on the palms and on the cover crop can be seen already. The palms on the treated plots are greener and the foliage has thickened up and a visual count of the nuts seen on the maturing inflorescences indicates that a material increase in crop is to be expected; the cover crop has shown a similar improvement in that the root systems of all the plants examined were larger and showed an astonishing increase in nodulation.

REFERENCES
1. Salgado, M. L. M. (1946): 'Use of Lime and Salt for Manuring Coconut Palms', *Coconut Research Scheme (Ceylon), Leaflet No.* 13.
2. Paltridge, T. B., and Santhirasegaram, K. (1957): 'Studies on the Nutrient Status of Some Coconut Soils in Ceylon'. *Coconut Research Institute (Ceylon), Bulletins Nos.* 12 *and* 13.

Farmer to Farmer

During the International Farmers' Convention next spring agriculturists from more than 25 countries will join their Israeli counterparts and will be introduced into the local farm life of Israel. Participants in the Convention programme – 5 to 12 April, 1959 – have been invited by Israeli farmers to be their personal guests for a 'Farmer to Farmer' week prior to the official opening of the Convention. During these activities the visitors will have a full-scale opportunity of observing and studying local methods of co-operative produce marketing, of attending meetings with Israeli farmers to discuss various professional problems of private and co-operative farming, and of seeing new developments in agricultural settlement. An Agricultural Exhibition, which will open in April 1959, will display Israel's achievements in all facets and aspects of this branch of local progress. In the commercial section foodstuffs and their by-products will be displayed by manufacturers, producers and co-operative wholesalers from all over the world.

Operation Termite

P. G. M. LEE
(*Singapore*)

The weak, pale, blind termite has survived the attacks of other living creatures for over a hundred million years until Man arrived to upset the balance of Nature. Today constant vigilance is necessary if they are to be prevented from doing enormous damage in a short space of time.

IN the balanced economy of a primeval forest the function of the termite is to clear up fallen trees and rotting stumps and return the material to the soil as organic matter. In modern methods of land clearing the vegetation is torn down and together with the brushwood and useless timber is burnt; huge earth-moving machines scrape off the top layers and the destruction of the termite colonies is almost complete. With the removal of the tree stumps the last source of food is taken away and there is no further reason for their continued existence.

Thus for a year or so after land clearing and levelling operations, huts and houses built on the site will be reasonably free of termites, but fresh invasions are impending from the uncleared areas of jungle surrounding the site.

On still evenings and after heavy rain huge swarms of winged colonists will be on the move – the future kings and queens of new termitaries. It is only during this brief period of mating flight that the termites can see at all; at other times they shun the light and live in darkness. The flying white ants are strongly attracted by a light and they flutter in their thousands towards the lighted houses. Then the trouble begins and the hitherto freed area is soon reinfested.

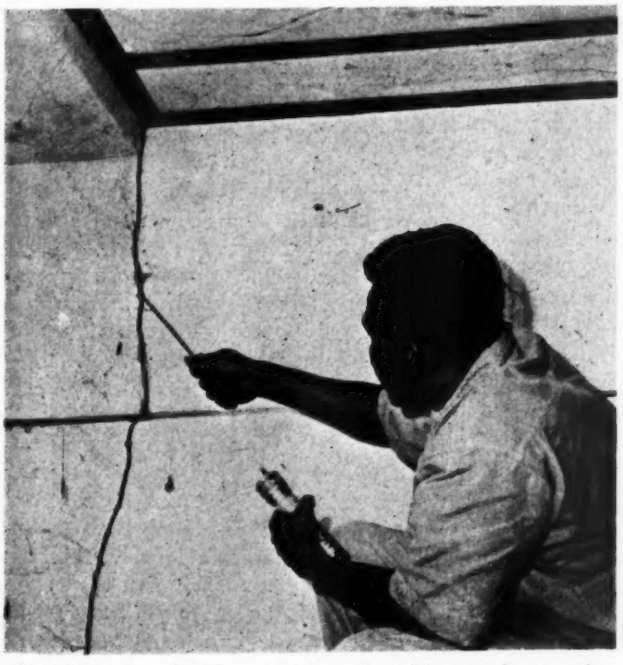
Given an adequate supply of water, availability of food and a protected site, a termite colony is potentially immortal. An ideal site for a termite colony can be below the concrete platform of a bungalow, with an assured water supply from cracks in monsoon drains or the seepage from the bathrooms or servants' washplaces. There they can plan and pursue their attacks protected from predatory creatures of all kinds and safe from all mankind except the trained pest control operator with poison dust and special technique.

Mr. V. Harris, of the Termite Research Unit, has compared termite attack to the patient underground work of sappers in a siege; equally the protection of large areas, such as a settlement or colony, needs to be organised like a military operation with three lines of action: protection, inspection and extermination.

Protection

Mechanical barriers consist of metal caps (termite shields) for wooden or concrete piles; metal or tarred building felt flashings between tops of dwarf walls etc.; timber wall plates; concrete ' feet ' for door posts or wall posts instead of burying the ends, unprotected, in concrete or soil; gaps between the tops of steps leading into a house and the house itself, and similar gaps between the patio (a veritable white ant trap) of permanent wooden bungalows and the bungalow itself.

Lethal barriers can be established



Applying poison dust into a gallery of working termites running up a house wall

Applying poison dust into the workings inside a hollow piece of wood

by the use of soil poisons or toxic chemicals, which are applied most economically and effectively while the building is under construction. The chemical should be poured into the foundations immediately before the concrete. The following methods have been recommended:

(i) A solution of 5% PCP in fuel oil, applied at a rate of 8 gal. per 100 sq. ft. so as to obtain a 1-in. penetration into the soil.

(ii) A solution of 5% of sodium pentachlorophenate in water applied at the rate of 16 gal. per 100 sq. ft. so as to obtain a 2-in. penetration.

(iii) A solution of 0.5% (by weight) of ' Dieldrex ' in water (*i.e.* 2 oz. to 2½ gal. of water), applied at the rate of 20 gal. per 100 sq. ft. so as to obtain a 2-in. to 3-in. penetration.

(iv) Sodium arsenate and water is also very effective, but it is dangerous to handle and will require considerable care if used in residential areas.

Wood preservatives used should contain a toxic element, such as dieldrin or PCP. All woodwork, particularly softwood and lesser hardwoods, should be coated with toxic preservative before, and not after, putting into the buildings. Impregnation by vacuum chambers is by far the best method and tanalizing is a proposition where many buildings of similar components are to be erected.

Lethal barriers or spraying with insecticides will only kill a limited number of worker termites, soldiers or nymphs. These methods will drive away attacks, but will seldom harm the termitary which will survive to attack again anywhere in a radius of several hundred yards. A termitary can accept enormous casualties without risk of extinction because the queen is capable of replacing them at the astonishing rate of some 60,000 eggs a day; she is assisted, in a well-established colony, by supplementary sexual types that can do just as well, depending on the requirements of the colony.

Inspection

Termites will in time find a way round any barrier – mechanical or lethal – and constant vigilance is necessary. Just as a military obstacle is of little use unless it is covered by fire or resolutely patrolled, so termite barriers will not be completely effective without periodical inspection. The frequency of inspection will vary with the conditions.

The work of inspection must be carried out by a trained pest control operator who knows what to look for, where to look and how to deal with the situation.

It is not an economic proposition simply to dig for termite colonies or to pour gallons of toxic liquids into the soil in the hope that they will soak into the actual colony that is attacking a house and thus destroy it.

Extermination

The cheapest and most effective control is to blow a finely divided arsenical powder into the white ant tunnels and workings. The dust is carried back to the queen on the bodies, legs or antennae of the workers and disseminated throughout the colony by the termites' habit of ' grooming ' one another. All the dead are eaten, the faecal pellets of waste matter being used as bricks in the walls of the colony. The queen, fed by the workers, dies first and in disposing of her poisoned corpse the workers, too, will die. This ensures the death of the entire colony in about five days, but it is necessary to inspect again after about a week to ensure complete extermination.

A pest control operator engaged for termite inspection and extermination must be intelligent, conscientious and alert and supervision is necessary if a satisfactory standard is to be maintained. The application of the poison dust requires some care and carelessly used will only drive the termites away without ensuring the destruction of the whole colony. A good operator will know the minute signs of infestation where the presence of white ants would not be suspected by the layman.

An organised programme of inspection to counter the assessed risk of termite attack can be so arranged that the annual price per building is only a very small fraction of other maintenance costs and is, in effect, a reasonable insurance premium.

Photos: Thomas Cowan & Co. Ltd., Singapore.

Plant Mutations by Irradiation

According to a recent report,* radiation is expected to make a valuable contribution to the breeding of improved varieties of plants. New varieties, developed from irradiated material, are already in use or ready for release to farmers in Sweden and the U.S.A. Other countries which have reported promising mutations include Germany, Austria, Belgium, Finland, France, India, Japan, Holland, Norway and the U.K.

Sweden has developed an improved variety of white mustard, which has already given a crop worth £15,000. She has produced higher-yielding strains of oil-bearing rape and peas, while new types of barley with short, stiff straw, better suited to mechanical harvesting, are being developed, as well as disease-resistant varieties of various crops. The total annual allocation for all the mutational research work in that country is less than £2,000.

Most of these developments had been achieved through irradiation with X-rays, but the U.S. has also reported practical achievements through the use of radiations derived from atomic energy programmes. The ionising radiation produces fundamentally the same kind of mutations as those in natural evolution, but only a small proportion are potentially useful. The value of irradiation lies in the vastly increased frequency of production of mutations needed by the plant breeder.

Irradiation, therefore, was a supplement to the time-consuming and painstaking procedure of selecting, breeding and testing – a procedure which geneticists have used for years in their search for improved varieties. These conventional methods of plant improvement are still necessary, particularly in countries where the possibilities of improving indigenous (native) varieties and of distributing high-quality seed have not yet been exhausted.

Plant breeding is one of the least expensive forms of agricultural improvement and yet one of the most rewarding. The use of radiations in plant breeding is only in its infancy and it is quite possible that the use of radiation to develop improved varieties of plants will rank amongst the most valuable of the contributions of atomic energy to the welfare of mankind.

**The Potential Contribution of Atomic Energy to Development in Agriculture and Related Industries.* R. A. Silow, FAO, Rome.

Couch Control

Observations with regard to the paper 'Control of Agropyron repens, Agrostis gigantea *and* Agrostis stolonifera *' by J. D. Fryer and R. J. Chancellor, and the subsequent discussion.*

The creeping menace of couch. A profile showing the underground rhizomes which spread in all directions and send out new aerial shoots

ONE of the papers presented at the Fourth British Weed Control Conference dealt with the effect of Dalapon on couch. It pointed out that this herbicide sometimes effects a splendid 'kill' of couch rhizomes, though sometimes, at the economic rate of application of 10 lb. per acre, the results are variable. Experiments have shown that this variability can be eliminated by ploughing about 8 in. deep, and a recommendation to this effect is actually given on the label.

Ploughing essential

When the performance data for application rates of 10 lb. per acre, given in the paper, are analysed, it will be seen that in the eight cases in the experiment where there was no ploughing after the application, six showed under 70% control and in some cases the reduction of the couch was as low as 17% and 25%; the average reduction of all eight cases where the Dalapon treatment was *not* followed by ploughing was 49%.

Of the six cases which were ploughed within three months of treatment, only two showed a control of under 70% but above 60%, and one of these was ploughed again in spring so that the soil was reinverted and the rhizomes brought to the surface, and the other was a stubble which was sprayed fairly late. The average reduction of couch in these six cases, where ploughing followed the treatment, was 80%.

In nearly all cases the ploughing was actually carried out much later than is recommended by the manufacturer, *i.e.* 2–6 weeks after treatment. Fryer's and Chancellor's data, therefore, bear out the hypothesis that more reliable couch suppression can be obtained by ploughing after Dalapon spraying.

Treatment of hedgebank. Left: *unsprayed;* right: *sprayed. The invasion of the cereal crop by couch on the unsprayed side can be seen*

Border treatment

It may therefore be concluded that couch control with this herbicide is economic and effective at the recommended rate of application, providing that the invasions of this weed from the hedge banks, borders and ditches, where no ploughing is possible, are prevented by extra heavy spraying at the rate of 20 to 25 lb. per acre. Such a high rate is, of course, not economic for general application.

On highly mechanised farms with small labour forces, weed-free farming without the use of chemical herbicides is not possible without fallows or an increase in the root shift. An increase in the root shift is not possible with a small labour force and fallows are uneconomic. The use of Dalapon, followed by ploughing, therefore appears to fill the need for the effective suppression of the difficult group of perennial weeds, popularly known as couch.

Weeds in Temperate Regions—I

Mammoth Programme at the Fourth British Weed Control Conference

The Opening Address at the Fourth British Weed Control Conference was given by Prof. H. G. Sanders, who in a witty speech quoted Prof. R. L. Wain's definition of a weed as a plant which, after you have pulled it out, grows again. He commented that ' it is up to us to stop it growing again.'

THE Conference was attended by more than 400 delegates from 17 Commonwealth and foreign countries, including 13 from Holland, seven from Germany, five from France, six from Italy, four from Denmark and three from the U.S.A. It was organised jointly by the British Weed Control Council and the Pesticides Group of the Society of Chemical Industry, and the scope of the proceedings covered all aspects of weed control. The proceedings of the Conference, which included three lectures and 50 papers, are to be published in full, but as this will take time we are publishing short abstracts of selected papers in this and succeeding issues.

In the first lecture Dr. E. K. Woodford, of the A.R.C. Unit of Experimental Agronomy at Oxford, drew attention to the lack of qualified advisers on weed control, other than those on the staffs of manufacturing firms. It would be right, he thought, for the State to assume more responsibility, with stricter laws concerning the declaration of the active ingredients in proprietary products. He considered that impartial advice was needed, as the science of weed control was becoming increasingly more complex. The farmer, he considered, needed advice from impartial consultants.

In his review of international progress, he pointed out that in the U.S.A. the industry expects the State to carry out most of the field evaluation of its new chemicals and thus be in a position to give advice concerning their use. In return the State assumes the right to lay down strict laws relating to the application of herbicides and expects the industry to carry out detailed research on residues and toxicology. In Great Britain, in contrast, the industry sets up its own field research organisations and does most of its own development work on new products. In return the State lays down the minimum of rules and regulations concerning the sale and use of herbicides, runs a voluntary Approvals Scheme for proprietary products, and allows industry to sell anything so long as it complies with the Poisonous Substances Act.

The rapid progress that has taken place in chemical weed control in Britain during the last ten years has been due in no small part to the cordial co-operation that has existed between the official and the commercial people engaged in the practical application of the new technology. Anything that would tend to detract from this partnership would be undesirable. The British Weed Control Council, he considered, can play an important part in helping to ensure that a happy balance is maintained between the sometimes divergent interests of the State and commercial enterprise.

TOTAL WEED CONTROL

The Control of Roadside Vegetation *by F. L. Smith (Gloucestershire County Council)*

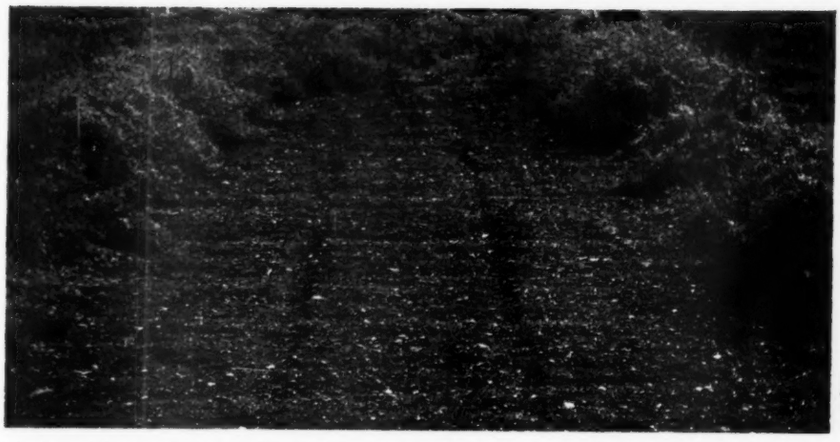
Certain herbicides and mixtures of herbicides can be used in overcoming some of the disadvantages of mechanical or manual methods of weed control. Chemical control shows substantial savings over the other methods and figures were given in support. Where selective weed control is practised the resulting crops of grass have also a commercial value as hay or silage, though not, of course, in the same year as spraying. Where there is scrub, chemical control makes repeated

Photo: *Farmer and Stockbreeder*

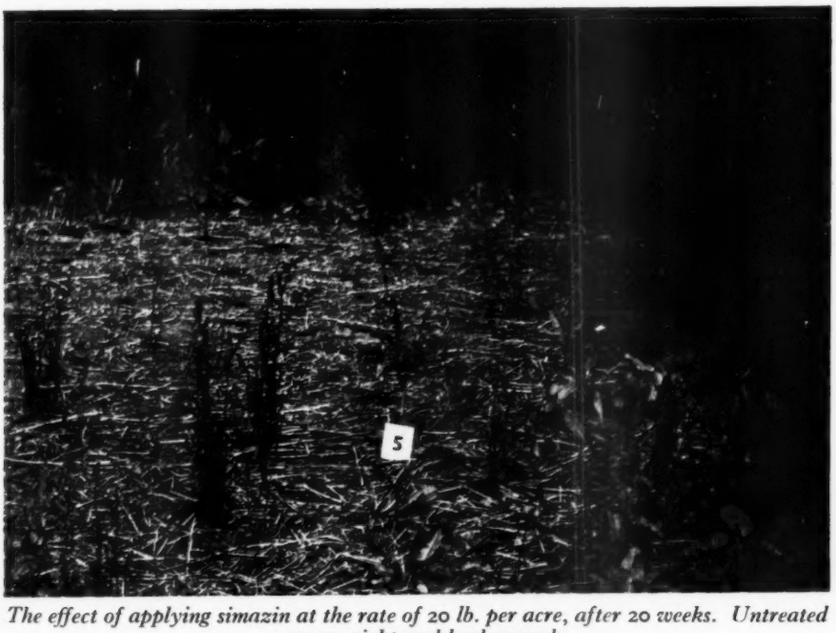
The President and Chairman of the British Weed Control Council (Prof. H. G. Sanders and Dr. E. Holmes) in earnest conversation with Mr. R. H. Beatty of the Weed Control Council of America

cutting unnecessary and so saves manpower. But there is always the factor of public opinion to be considered – there is the ever-present danger of spray-drift causing damage to neighbouring crops and to the hedgerows, and this emphasises the need for well-trained operators.

The hormone 2,4-D at 5 lb./acre in 100 gal. was used for selective weed control to obtain attractive verges. This is applied in the spring, causing some retardation of the grass. Some weeds require several treatments for complete eradication with spring and autumn sprayings for two years, and with subsequent spot spraying to secure their complete eradication.



A logarithmic strip produced by a logarithmic sprayer. Simazin was applied at 20 lb. per acre to the foreground, decreasing to 1 lb. Vegetation was controlled for three-quarters of the distance



The effect of applying simazin at the rate of 20 lb. per acre, after 20 weeks. Untreated areas: right and background

For more comprehensive control a mixture of maleic hydrazide and 2,4-D in 100 gal. of water was sprayed early in good weather.

For the control of scrub, *i.e.* ash, elder, hawthorn, elm, sycamore, gorse and broom, a mixture of 2,4-D and 2,4,5-T in diesel oil or waste engine oil was applied at any time during the winter and gave 90% eradication.

Advances in Total Weed Control *by J. R. Cox (Fisons Pest Control Ltd.)*

The initial treatment of established vegetation in total weed control places heavy demands on any single weed-killer. Recent developments in selective weed control have led to the use of mixtures of chemicals to control a wider range of weeds. A similar development in total weed control would also widen the range of weeds controlled and place less demands on any single chemical.

Experiments have been carried out in 1958 with many chemicals as additives to simazin, and examples of some of these compounds include MCPA, 2,3,6-TBA, 2,4-D, 2,4,5-T, trichloracetic acid, sodium chlorate, and many triazine compounds closely related to simazin. The chemicals used as additives were tested either singly or in groups, at logarithmically decreasing dosage rates with simazin at a constant rate.

It was found that in all cases the use of mixtures increased the initial effects, but in most of the mixtures there was a slight deterioration after 15 weeks.

The main disadvantage of the use of mixtures of chemicals with simazin is that the optimum time for application of each constituent in the mixture may be different, and the optimum time for the mixture itself is therefore a compromise. Thus, if application was made outside the optimum time, one or more of the constituent chemicals might not prove effective.

Observation Studies on Total Herbicides *by R. G. Hughes (N.A.A.S.)*

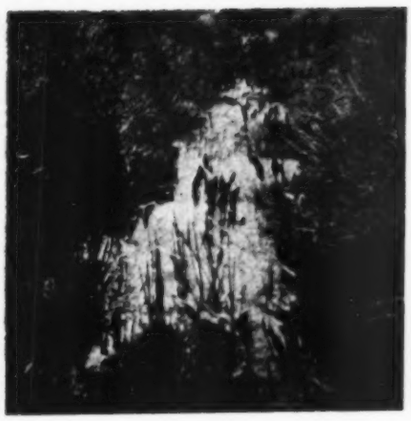
Four main groups of chemicals – simazin, monuron, a monuron/borate combination and a chlorate/borate mixture – were included as basic treatments at various rates of application.

Amongst basic treatments applied in this study, simazin and monuron/borate combinations, particularly at the higher rates of application, have given the most satisfactory results in non-selective weed control. It is comparatively easy by means of a combination of basic treatments, followed by maintenance treatments, to produce a 90% weed-free area, but there is always some resistant plant species eager, willing and able to recolonise bare ground. The flora of a site can be changed completely by the use of chemicals and on some sites a regrowth of grass, in absence of dicotyledon weeds, may be an advantage.

AQUATIC WEED CONTROL

The Weed Problem in Rivers and Drainage Channels *by J. V. Spalding*

Aquatic weeds have a limited use in



A neglected and useless watercourse choked with weeds

Photos: Coombs

A cleared drainage channel in which the water is free to move

preventing the slipping and erosion of the banks of watercourses and in providing food for fish, and these two facts need to be borne in mind. They do, however, prevent the free flow of water and need to be controlled.

They can be divided roughly into three types: submerged, emergent, and algae or floating weeds. The most usual method of control for all three types is by cutting and removal, either by hand or by mechanical means, and these are operations which can be regulated so as not to affect the fish life. Cutting also leaves the roots more or less intact, so that the bed and sides of the channel are not seriously disturbed. But such operations are becoming increasingly expensive and it is difficult to get labour for this work.

Control of such weeds by chemicals should be with the object rather of preventing growth than of killing existing weeds – anything, in fact, which obviates the need for the costly lifting of dead weeds out of the channel. If growth can be restricted, while still retaining some root system, the banks of the channel will be held.

Most promising results with emergent weeds have been obtained by spraying the emergent growth with chemicals, but the dead growth has still to be removed and it is not possible severely to restrict the growths of this type of weeds, because they are already large when they reach the surface.

The ideal method thus appears to be the introduction of some chemical into the water which can rapidly spread along the watercourse. Another possibility is the introduction of a surface film which will cling to the foliage, and another is the injection of a persistent sterilant into the mud in the drain bottom.

Most of the available chemicals are selective in their action, but little purpose is served if a few species are killed only to make room for others. For a chemical to be of practical value it must control the majority of the weeds; it must also be harmless to fish, animals and, of course, human beings, and it must not affect crops growing on adjacent land by attacking the roots via the tile drains.

The Control of Aquatic Weeds by Copper Sulphate *by R. J. Chancellor (A.R.C. Unit of Experimental Agronomy), A. V. Coombs (The British Sulphate of Copper Association Ltd.) and H. S. Foster (McKechnie Brothers Ltd.)*

Watercourses at two sites were treated continuously for up to six months with copper sulphate to maintain approximately 1 p.p.m. of copper in the water at the treatment point. At another site treatment was given at 0.25 p.p.m. of copper.

Effects on weed growth extended downstream for over a mile from the treatment point. The most notable was the suppression of algae, which allowed a faster and freer flow of water. The susceptibility of different species of aquatic weeds to copper varied greatly. Susceptible and resistant species are listed.

This list suggests that, in general, plants which are submerged or floating are susceptible, while those which are emergent are resistant presumably because they are deep-rooted. The only exceptions are the two species of *Callitriche*. This resistance of *Callitriche* is outstanding and of importance.

The susceptible weeds were generally destroyed quite early in the treatment and were still absent many months after treatment ceased.

(*To be continued*)

Weed Control in the Tropics—III

This concludes the account of the Second African Weed Control Conference at Victoria Falls

Weed Control at Arusha Chini Sugar Estate *by L. B. Bjorking (Tanganyika Planting Co. Ltd.)*

The following herbicidal chemicals are in regular use at Arusha Chini:

(*a*) MCPA for pre-emergence and early post-emergent.

(*b*) 2,4-D, mainly in the amine form as a post-emergent spray, which normally constitutes the second or third application in planted fields and the first application on ratoon fields.

(*c*) Dalapon on the irrigation system, followed by 2,4-D.

(*d*) PCP, in small quantity, mainly in the irrigation water together with 2,4-D to deal with aquatic weeds.

MCPA is applied as a pre-emergence spray at 2 lb. acid per acre by knapsack sprayers as soon after the first irrigation as soil conditions permit. The dosage of 2 lb. is only arbitrary; it may be increased to 4 lb. and even 6 lb. acid in the river area where a more moist soil is heavily infested with *Cyperus* spp. Under such conditions these heavy doses have given good results without harming the cane, provided that the cane has not sprouted. Care must, however, be taken if the cane is about to spike.

For post-emergent spray they use mainly 2,4-D in its amine formulation, such as triethanolamine. Post-emergent sprays are mostly applied by aeroplane in early morning operations. Cases of scorching on cane sprayed

from the air after 10 a.m. have occurred.

Normal applications of MCPA and 2,4-D mixtures are dealing quite effectively with common broad-leaved weeds when properly timed, as also is the case with most of the annual grasses, but the timing, *i.e.* the seed-leaf stage before normal leaves are formed, is important.

After repeated spraying with the hormone type of chemicals, chemically-resistant weeds and perennial grasses become a serious problem and the answer, in fact, is intensive cultivation and the use of fertilisers. Several types of grass killers have been tried between the cane rows; so far dalapon has been most successful, but its use in large-scale operations is limited by the cost. CMU is also prohibitive in cost.

The Use of ' Activated ' DNBP and 2,4-DB for Weed Control in Lucerne *by D. M. Rocco* (*East Africa*)

The problem of the control of young weeds in seedling lucerne has been satisfactorily solved, but the control of mature weeds in adult lucerne was a problem that could not be treated economically with a 2,4-DB/DNBP mixture, as the rates necessary for control were so high as to render the operation far more costly than the use of hand labour. A theory was put forward that the DNBP was proving less effective in East Africa than in the U.K. because of the alkalinity of the local water – 400 parts per million, expressed as $CaCO_3$ and a *p*H of 8–9. This might diminish the efficacy of the DNBP due to its having to neutralise the water.

A series of tests was carried out with a Chesterford logarithmic sprayer (World Crops, 1957, **9**, 321) in which a standard DNBP solution was combined with a decreasing concentration of sulphuric acid. These trials showed that the effect of acidification went further than the neutralisation of the water.

Owing to the impossibility of using sulphuric acid as an activator in a normal spray tank, due to its corrosive action, ammonium sulphate was used instead and found to be satisfactory.

The use of such ' activated ' DNBP has now become a standard weed control operation in lucerne and it has been found that 0.4 lb.a.e. of the DNBP triethanolamine salt plus 4 lb. ammonium sulphate is sufficient to control the majority of the weeds present.

As a consequence of the development of the use of such mixed herbicides in lucerne it has been found that, not only has there been a considerable economy in the management of lucerne due to lower costs of cleaning, but it has also been possible to extend the area under lucerne at a higher rate than before, when the average established in any one year was in direct proportion to the availability of the labour required to keep it clean.

Weed Control in Groundnuts *by C. Parker* (*Fisons Pest Control* (*S.A.*) *Ltd.*)

Pre-emergence spraying with 2,4-D or MCPA at moderate rates may be used for control of most annual weeds in groundnuts, but will not control *Cyperus* spp., *Datura* spp., *Xanthium* spp. or *Tribulus terrestris*, and there may also be more general failure under dry soil conditions.

Certain other pre-emergence treatments, such as CDAA, dinoseb, PCP or 2,4-DES, may be safer than 2,4-D and MCPA, but are very much more expensive and cannot be relied upon to give consistently superior weed control, especially under dry conditions.

There is some evidence that after pre-emergence spraying with 2,4-D or MCPA results with post-emergence 2,4-DB or MCPB are better, especially on *Datura* spp. Annual grasses are normally controlled by pre-emergence 2,4-D or MCPA, but, if necessary, they may be checked when very young, not more than ½ in. across, by 1½ lb. MCPB or 2,4-DB applied post-emergence, the former possibly being the more effective. This is safe up to the 6-in. dia. stage of groundnuts. If there is a germination of grass later than this, *i.e.* after the crop is 6 in. across, as sometimes occurs, it is possible that TCA at 3–4 lb./acre may be safely used, but the grass must be not larger than 1 in. across for successful results. It should not be used when the crop is any younger than the 6-in. stage.

A New Quaternary Ammonium Herbicide *by E. Holmes* (*Plant Protection Ltd.*)

Research work at the I.C.I. Jealott's Hill Laboratories has led to the discovery of a new quaternary ammonium herbicide, 1:1'ethylene-2:2'dipyridylium dibromide (vide *Nature*, 1958, **181**, 446-447).

Some of its more outstanding characteristics may be outlined. The material is readily soluble in water to the extent of 70 g. in 100 c.c. of water at 20°C and is stable in acid or neutral solution, but is decomposed by strong alkalis. It is non-explosive, non-inflammable and non-volatile.

This compound is very rapidly absorbed into the aerial parts of plants and translocated both upwards and downwards. This indicates, first, that the material is not likely to be affected by rain falling shortly after application and, secondly, that it is suitable for low-volume application. The phytocidal action is extremely rapid on the aerial parts of the plants, but normally does not extend below soil level. The characteristic damage symptom on susceptible plants is wilting, which in the case of herbaceous plants is followed by general collapse. On more resistant plants, temporary chlorosis may be evident. On contact with the soil the compound is immediately absorbed and completely inactivated; thus there is no residual activity.

The new compound is now being

A small plot of Bouncing Bet (U.S.A.) or Soapwort (U.K.) showing the effect of treatment with the new quaternary ammonium herbicide

tested for defoliation and desiccation of cotton, desiccation of leguminous seed crops, weed control in cotton and sugar-cane by directed spraying, total 'top killing' on railroads, road verges and irrigation ditches, potato haulm destruction, control of vegetation in firebreaks, fallow weed control and on other problems involving destruction of aerial growth of plants, such as brush-killing.

Methyl Bromide for the Sterilisation of Seedbed Soils *by C. H. Cronin (Fisons Pest Control (Central Africa) Ltd.)*

Methyl bromide is one of the most effective chemicals at present available for soil sterilisation in seedbeds and is already widely used by tobacco growers in several parts of the world. The use of this chemical is increasing rapidly on account of its high efficiency, rapidity of action and relatively low dosage rate in comparison with many other soil sterilants.

It is effective in controlling a large variety of weed seeds and soil organisms when applied to damp, finely-tilled soil at 1 lb. per 100 sq. ft. The soil temperature should be reasonably high and the gas should be confined over the soil to be sterilised by a gasproof cover for a period of 24–48 hours. This is necessary for effective fumigation and constant watch is necessary to reduce tears and punctures to a minimum, and also to see that these are promptly repaired when they occur. Methyl bromide is not always effective at low soil temperatures.

Many crops may safely be sown within 48 hours of the end of fumigation, but a few have been found to be sensitive to the bromine residues remaining in the soil or the high ammonia/nitrate nitrogen ratio present in the soil for a period following treatment. Methyl bromide is not an ideal chemical for temporary soil sterilisation, as it is poisonous to man and stock.

New Technique for Locust Control

A method of spraying which may have other applications in the field of pest control.

A NEW method of controlling locusts in their early stages has recently been developed by the Desert Locust Survey Organisation of the East African High Commission, with the co-operation of the Governments of the Sudan, Libya and Ethiopia, which, it is hoped, will increase the efficiency and reduce the high cost of the control operations.

The new technique uses a simple, inexpensive and ingenious spraying device consisting of a single spray nozzle fixed to the end of an upright extension of the exhaust pipe of a light cross-country vehicle. Pressure from the exhaust forces the liquid out of the tank and atomises it as it emerges from the nozzle jet. The resulting spray is allowed to drift down-wind on to vegetation on which locusts will subsequently feed.

Success depends on the persistence of the deposit of insecticide, since the longer the vegetation remains toxic to locusts, the more will be killed. Dieldrin, applied as a concentrated solution in oil, has proved to be particularly suitable for this purpose, and has given spectacular results at dosage rates as low as ¼ pint per acre, the deposit remaining effective for some five to six weeks.

Photo: Shell

Libya. A cross-country vehicle, fitted with the new exhaust spraying device, operating in locust country

The main economy is in the reduction of transport costs – the heaviest item of expense in this work. Comparing the new technique with baiting – 1 lb. of dieldrin/oil spray can kill as many locusts as 20 lb. of poison bait. This means that the vehicle used to operate the sprayer can also carry and distribute as much insecticide as would otherwise have to be brought to the scene of operations in a 5-ton truck, and, furthermore, the bait would still have to be unloaded and distributed mechanically or by hand.

To enable locust control authorities in the locust-infested regions, covering nine million square miles of Africa and Asia, to carry out tests under their own conditions, Shell are making available a limited number of these sprayers, together with trial samples of the dieldrin/oil solution. It is hoped that this will lead to the wider adoption of the new technique in the fight against that old and voracious pest – the desert locust.

New Publications

Weed Control

Issued by the Weed Control Council. Pp. 245. Oxford. Blackwell Scientific Publications. 12s. 6d.

The development of the new science of weed control has been so very rapid that research has far outstripped education and instruction in the use of the new herbicides and in the understanding of the principles of their modes of action. Neither extension or advisory officers, nor planters, farmers, fruit growers or market gardeners are now able to decide for themselves which is the correct herbicide for their particular requirements out of the 80 or so patent formulations now on the market. Even specialists in this field of work find difficulty in keeping abreast of the latest developments and need a general book giving authoritative information.

The Weed Control Handbook is indeed a *vade mecum* on weeds, herbicides, their mode of action and on the laws relating to their use. The material has been prepared by the Recommendations Committee of the British Weed Control Council and has been edited by the staff of the Agricultural Research Council of the Unit of Experimental Agronomy at Oxford. It is well produced, well indexed, clearly expressed and up to date.

The book lists the weeds and their susceptibilities, the crops, including forest, trees and their resistances, and the chemical formulae, scientific and common names of each individual herbicide and the various proprietary patent formulations based on each. There is a comprehensive glossary of botanical and technical terms, which will be as valuable to the layman as a dictionary. The legal aspects of the use of herbicides are considered, together with the important problem of spray drift; an account is also given of the voluntary scheme for the approval of insecticides, fungicides and weedkillers now in force in the U.K.

In the foreword Prof. H. C. Sanders, Chief Scientific Adviser to the Ministry of Agriculture, invites suggestions for the improvement of future editions. We would therefore suggest that more attention should be directed to the quantitative aspect – the evaluation of the different herbicides in terms of cost, in terms of crop increases, in terms of labour saved and an effective comparison of the financial advantages of chemical over manual or mechanical methods of weed control. There is no one to advise the agriculturist except the representatives of the various commercial firms or contractors who have a direct interest in pushing the formulations and the methods with which they are directly concerned.

There is also an urgent – a more urgent need for a companion volume on 'Tropical Weed Control', as those working in the backward and in the under - developed countries are in greater need of advice and information than those engaged in agriculture in the more highly industrialised countries of the temperate zone. The present volume will, nevertheless, help those who are engaged in research and on plantations in the tropics.

This is a book of reference – a compendium of knowledge – which must not be buried in the archives of libraries, but should be immediately available on the desks of all botanists, agronomists and crop specialists, and in the office of every extension officer, planter and farmer.

F. C. COOKE

Science and Practice in the Manuring of Rice

By Dr. H. Glander. Green Bulletin Information about Manuring No. 6. Pp. 27. Verlagsgesellschaft für Ackerbau m.b.H. Hannover. Sophienstrasse 1. 1957.

The purpose of this booklet is to advance the claims of potash fertilising in rice growing. To achieve his object, the author has stated all that may be said in favour of potash and also given some conflicting evidence.

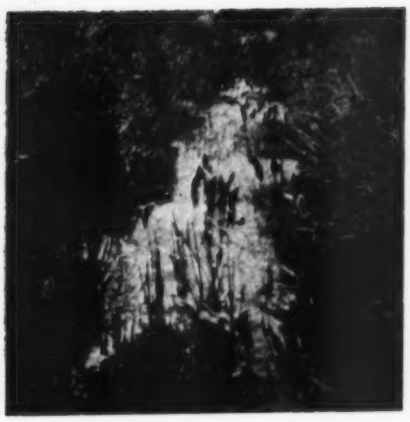
Dr. Glander contrasts the average yields in a number of countries with yields obtained on experimental stations in these regions. Thus he shows that great scope exists for better fertilising and cultural methods. Rice soils in a number of countries are compared, chemical and mechanical analyses stated and the amount of nutrients removed by the crop quoted by reference to research work. This brings out the importance of potash to the plant as well as its physiological effect on the crop. However, the writer omits reference to the supply of nutrients carried in irrigation water. Den Berger, for instance, concluded that in Java sufficient supplies of potash are carried to the crop in this manner.

The subsequent sections are devoted to the yield-increasing power of potash fertilisers in a number of countries, as exemplified by experiments, and the influence of potash fertilisers on disease resistance. Final sections discuss the absorption of potash by rice and the symptoms of potash deficiency.

It is contended that so long as yields are kept low by general nutrient deficiency, or are limited by another growth factor, characteristic symptoms of potash deficiency do not occur. With a low level of all nutrients the addition of a single nutrient often upsets the state of equilibrium and reduces other growth factors to such a low relative value that yields are depressed. In fertilising, therefore, all the nutrients must be taken into consideration and potash must take its place in the fertilising programme. It is conceded that the mutual relationship of fertilisers depends mostly on local conditions and the physiological requirements of individual rice varieties.

Dr. Glander has succeeded in writing a very concise and interesting treatise on rice production with special reference to potash. Many readers will not agree with all his conclusions, but that is to be expected. Potash is less generally required on rice soils than are nitrogen and phosphates, probably because these soils are usually of a heavy nature and contain adequate quantities of this element. On light soils, however, potash frequently gives an increased yield, while there is abundant evidence that potash alone is often ineffective, whereas when applied with nitrogen and phosphates it may produce heavier crops.

D. H. GRIST



A neglected and useless watercourse choked with weeds

Photos: Coombs

A cleared drainage channel in which the water is free to move

preventing the slipping and erosion of the banks of watercourses and in providing food for fish, and these two facts need to be borne in mind. They do, however, prevent the free flow of water and need to be controlled.

They can be divided roughly into three types: submerged, emergent, and algae or floating weeds. The most usual method of control for all three types is by cutting and removal, either by hand or by mechanical means, and these are operations which can be regulated so as not to affect the fish life. Cutting also leaves the roots more or less intact, so that the bed and sides of the channel are not seriously disturbed. But such operations are becoming increasingly expensive and it is difficult to get labour for this work.

Control of such weeds by chemicals should be with the object rather of preventing growth than of killing existing weeds – anything, in fact, which obviates the need for the costly lifting of dead weeds out of the channel. If growth can be restricted, while still retaining some root system, the banks of the channel will be held.

Most promising results with emergent weeds have been obtained by spraying the emergent growth with chemicals, but the dead growth has still to be removed and it is not possible severely to restrict the growths of this type of weeds, because they are already large when they reach the surface.

The ideal method thus appears to be the introduction of some chemical into the water which can rapidly spread along the watercourse. Another possibility is the introduction of a surface film which will cling to the foliage, and another is the injection of a persistent sterilant into the mud in the drain bottom.

Most of the available chemicals are selective in their action, but little purpose is served if a few species are killed only to make room for others. For a chemical to be of practical value it must control the majority of the weeds; it must also be harmless to fish, animals and, of course, human beings, and it must not affect crops growing on adjacent land by attacking the roots via the tile drains.

The Control of Aquatic Weeds by Copper Sulphate *by R. J. Chancellor (A.R.C. Unit of Experimental Agronomy), A. V. Coombs (The British Sulphate of Copper Association Ltd.) and H. S. Foster (McKechnie Brothers Ltd.)*

Watercourses at two sites were treated continuously for up to six months with copper sulphate to maintain approximately 1 p.p.m. of copper in the water at the treatment point. At another site treatment was given at 0.25 p.p.m. of copper.

Effects on weed growth extended downstream for over a mile from the treatment point. The most notable was the suppression of algae, which allowed a faster and freer flow of water. The susceptibility of different species of aquatic weeds to copper varied greatly. Susceptible and resistant species are listed.

This list suggests that, in general, plants which are submerged or floating are susceptible, while those which are emergent are resistant presumably because they are deep-rooted. The only exceptions are the two species of *Callitriche*. This resistance of *Callitriche* is outstanding and of importance.

The susceptible weeds were generally destroyed quite early in the treatment and were still absent many months after treatment ceased.

(To be continued)

Weed Control in the Tropics—III

This concludes the account of the Second African Weed Control Conference at Victoria Falls

Weed Control at Arusha Chini Sugar Estate *by L. B. Bjorking (Tanganyika Planting Co. Ltd.)*

The following herbicidal chemicals are in regular use at Arusha Chini:

(*a*) MCPA for pre-emergence and early post-emergent.

(*b*) 2,4-D, mainly in the amine form as a post-emergent spray, which normally constitutes the second or third application in planted fields and the first application on ratoon fields.

(*c*) Dalapon on the irrigation system, followed by 2,4-D.

(*d*) PCP, in small quantity, mainly in the irrigation water together with 2,4-D to deal with aquatic weeds.

MCPA is applied as a pre-emergence spray at 2 lb. acid per acre by knapsack sprayers as soon after the first irrigation as soil conditions permit. The dosage of 2 lb. is only arbitrary; it may be increased to 4 lb. and even 6 lb. acid in the river area where a more moist soil is heavily infested with *Cyperus* spp. Under such conditions these heavy doses have given good results without harming the cane, provided that the cane has not sprouted. Care must, however, be taken if the cane is about to spike.

For post-emergent spray they use mainly 2,4-D in its amine formulation, such as triethanolamine. Post-emergent sprays are mostly applied by aeroplane in early morning operations. Cases of scorching on cane sprayed

from the air after 10 a.m. have occurred.

Normal applications of MCPA and 2,4-D mixtures are dealing quite effectively with common broad-leaved weeds when properly timed, as also is the case with most of the annual grasses, but the timing, *i.e.* the seed-leaf stage before normal leaves are formed, is important.

After repeated spraying with the hormone type of chemicals, chemically-resistant weeds and perennial grasses become a serious problem and the answer, in fact, is intensive cultivation and the use of fertilisers. Several types of grass killers have been tried between the cane rows; so far dalapon has been most successful, but its use in large-scale operations is limited by the cost. CMU is also prohibitive in cost.

The Use of ' Activated ' DNBP and 2,4-DB for Weed Control in Lucerne *by D. M. Rocco* (*East Africa*)

The problem of the control of young weeds in seedling lucerne has been satisfactorily solved, but the control of mature weeds in adult lucerne was a problem that could not be treated economically with a 2,4-DB/DNBP mixture, as the rates necessary for control were so high as to render the operation far more costly than the use of hand labour. A theory was put forward that the DNBP was proving less effective in East Africa than in the U.K. because of the alkalinity of the local water – 400 parts per million, expressed as $CaCO_3$ and a *p*H of 8–9. This might diminish the efficacy of the DNBP due to its having to neutralise the water.

A series of tests was carried out with a Chesterford logarithmic sprayer (WORLD CROPS, 1957, **9**, 321) in which a standard DNBP solution was combined with a decreasing concentration of sulphuric acid. These trials showed that the effect of acidification went further than the neutralisation of the water.

Owing to the impossibility of using sulphuric acid as an activator in a normal spray tank, due to its corrosive action, ammonium sulphate was used instead and found to be satisfactory.

The use of such ' activated ' DNBP has now become a standard weed control operation in lucerne and it has been found that 0.4 lb.a.e. of the DNBP triethanolamine salt plus 4 lb. ammonium sulphate is sufficient to control the majority of the weeds present.

As a consequence of the development of the use of such mixed herbicides in lucerne it has been found that, not only has there been a considerable economy in the management of lucerne due to lower costs of cleaning, but it has also been possible to extend the area under lucerne at a higher rate than before, when the average established in any one year was in direct proportion to the availability of the labour required to keep it clean.

Weed Control in Groundnuts *by C. Parker* (*Fisons Pest Control (S.A.) Ltd.*)

Pre-emergence spraying with 2,4-D or MCPA at moderate rates may be used for control of most annual weeds in groundnuts, but will not control *Cyperus* spp., *Datura* spp., *Xanthium* spp. or *Tribulus terrestris*, and there may also be more general failure under dry soil conditions.

Certain other pre-emergence treatments, such as CDAA, dinoseb, PCP or 2,4-DES, may be safer than 2,4-D and MCPA, but are very much more expensive and cannot be relied upon to give consistently superior weed control, especially under dry conditions.

There is some evidence that after pre-emergence spraying with 2,4-D or MCPA results with post-emergence 2,4-DB or MCPB are better, especially on *Datura* spp. Annual grasses are normally controlled by pre-emergence 2,4-D or MCPA, but, if necessary, they may be checked when very young, not more than ½ in. across, by 1½ lb. MCPB or 2,4-DB applied post-emergence, the former possibly being the more effective. This is safe up to the 6-in. dia. stage of groundnuts. If there is a germination of grass later than this, *i.e.* after the crop is 6 in. across, as sometimes occurs, it is possible that TCA at 3–4 lb./acre may be safely used, but the grass must be not larger than 1 in. across for successful results. It should not be used when the crop is any younger than the 6-in. stage.

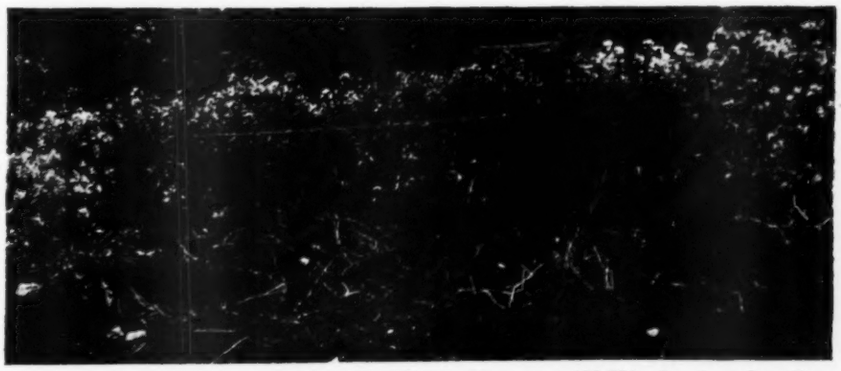
A New Quaternary Ammonium Herbicide *by E. Holmes* (*Plant Protection Ltd.*)

Research work at the I.C.I. Jealott's Hill Laboratories has led to the discovery of a new quaternary ammonium herbicide, 1:1'ethylene-2:2'dipyridylium dibromide (vide *Nature*, 1958, **181**, 446-447).

Some of its more outstanding characteristics may be outlined. The material is readily soluble in water to the extent of 70 g. in 100 c.c. of water at 20°C and is stable in acid or neutral solution, but is decomposed by strong alkalis. It is non-explosive, non-inflammable and non-volatile.

This compound is very rapidly absorbed into the aerial parts of plants and translocated both upwards and downwards. This indicates, first, that the material is not likely to be affected by rain falling shortly after application and, secondly, that it is suitable for low-volume application. The phytocidal action is extremely rapid on the aerial parts of the plants, but normally does not extend below soil level. The characteristic damage symptom on susceptible plants is wilting, which in the case of herbaceous plants is followed by general collapse. On more resistant plants, temporary chlorosis may be evident. On contact with the soil the compound is immediately absorbed and completely inactivated; thus there is no residual activity.

The new compound is now being



A small plot of Bouncing Bet (U.S.A.) or Soapwort (U.K.) showing the effect of treatment with the new quaternary ammonium herbicide

tested for defoliation and desiccation of cotton, desiccation of leguminous seed crops, weed control in cotton and sugar-cane by directed spraying, total ' top killing ' on railroads, road verges and irrigation ditches, potato haulm destruction, control of vegetation in firebreaks, fallow weed control and on other problems involving destruction of aerial growth of plants, such as brush-killing.

Methyl Bromide for the Sterilisation of Seedbed Soils *by C. H. Cronin (Fisons Pest Control (Central Africa) Ltd.)*

Methyl bromide is one of the most effective chemicals at present available for soil sterilisation in seedbeds and is already widely used by tobacco growers in several parts of the world. The use of this chemical is increasing rapidly on account of its high efficiency, rapidity of action and relatively low dosage rate in comparison with many other soil sterilants.

It is effective in controlling a large variety of weed seeds and soil organisms when applied to damp, finely-tilled soil at 1 lb. per 100 sq. ft. The soil temperature should be reasonably high and the gas should be confined over the soil to be sterilised by a gasproof cover for a period of 24–48 hours. This is necessary for effective fumigation and constant watch is necessary to reduce tears and punctures to a minimum, and also to see that these are promptly repaired when they occur. Methyl bromide is not always effective at low soil temperatures.

Many crops may safely be sown within 48 hours of the end of fumigation, but a few have been found to be sensitive to the bromine residues remaining in the soil or the high ammonia/nitrate nitrogen ratio present in the soil for a period following treatment. Methyl bromide is not an ideal chemical for temporary soil sterilisation, as it is poisonous to man and stock.

New Technique for Locust Control

A method of spraying which may have other applications in the field of pest control.

A NEW method of controlling locusts in their early stages has recently been developed by the Desert Locust Survey Organisation of the East African High Commission, with the co-operation of the Governments of the Sudan, Libya and Ethiopia, which, it is hoped, will increase the efficiency and reduce the high cost of the control operations.

The new technique uses a simple, inexpensive and ingenious spraying device consisting of a single spray nozzle fixed to the end of an upright extension of the exhaust pipe of a light cross-country vehicle. Pressure from the exhaust forces the liquid out of the tank and atomises it as it emerges from the nozzle jet. The resulting spray is allowed to drift down-wind on to vegetation on which locusts will subsequently feed.

Success depends on the persistence of the deposit of insecticide, since the longer the vegetation remains toxic to locusts, the more will be killed. Dieldrin, applied as a concentrated solution in oil, has proved to be particularly suitable for this purpose, and has given spectacular results at dosage rates as low as ¼ pint per acre, the deposit remaining effective for some five to six weeks.

Photo: Shell

Libya. A cross-country vehicle, fitted with the new exhaust spraying device, operating in locust country

The main economy is in the reduction of transport costs – the heaviest item of expense in this work. Comparing the new technique with baiting – 1 lb. of dieldrin/oil spray can kill as many locusts as 20 lb. of poison bait. This means that the vehicle used to operate the sprayer can also carry and distribute as much insecticide as would otherwise have to be brought to the scene of operations in a 5-ton truck, and, furthermore, the bait would still have to be unloaded and distributed mechanically or by hand.

To enable locust control authorities in the locust-infested regions, covering nine million square miles of Africa and Asia, to carry out tests under their own conditions, Shell are making available a limited number of these sprayers, together with trial samples of the dieldrin/oil solution. It is hoped that this will lead to the wider adoption of the new technique in the fight against that old and voracious pest – the desert locust.

New Publications

Weed Control

Issued by the Weed Control Council. Pp. 245. Oxford. Blackwell Scientific Publications. 12s. 6d.

The development of the new science of weed control has been so very rapid that research has far outstripped education and instruction in the use of the new herbicides and in the understanding of the principles of their modes of action. Neither extension or advisory officers, nor planters, farmers, fruit growers or market gardeners are now able to decide for themselves which is the correct herbicide for their particular requirements out of the 80 or so patent formulations now on the market. Even specialists in this field of work find difficulty in keeping abreast of the latest developments and need a general book giving authoritative information.

The Weed Control Handbook is indeed a *vade mecum* on weeds, herbicides, their mode of action and on the laws relating to their use. The material has been prepared by the Recommendations Committee of the British Weed Control Council and has been edited by the staff of the Agricultural Research Council of the Unit of Experimental Agronomy at Oxford. It is well produced, well indexed, clearly expressed and up to date.

The book lists the weeds and their susceptibilities, the crops, including forest, trees and their resistances, and the chemical formulae, scientific and common names of each individual herbicide and the various proprietary patent formulations based on each. There is a comprehensive glossary of botanical and technical terms, which will be as valuable to the layman as a dictionary. The legal aspects of the use of herbicides are considered, together with the important problem of spray drift; an account is also given of the voluntary scheme for the approval of insecticides, fungicides and weedkillers now in force in the U.K.

In the foreword Prof. H. C. Sanders, Chief Scientific Adviser to the Ministry of Agriculture, invites suggestions for the improvement of future editions. We would therefore suggest that more attention should be directed to the quantitative aspect – the evaluation of the different herbicides in terms of cost, in terms of crop increases, in terms of labour saved and an effective comparison of the financial advantages of chemical over manual or mechanical methods of weed control. There is no one to advise the agriculturist except the representatives of the various commercial firms or contractors who have a direct interest in pushing the formulations and the methods with which they are directly concerned.

There is also an urgent – a more urgent need for a companion volume on 'Tropical Weed Control', as those working in the backward and in the under - developed countries are in greater need of advice and information than those engaged in agriculture in the more highly industrialised countries of the temperate zone. The present volume will, nevertheless, help those who are engaged in research and on plantations in the tropics.

This is a book of reference – a compendium of knowledge – which must not be buried in the archives of libraries, but should be immediately available on the desks of all botanists, agronomists and crop specialists, and in the office of every extension officer, planter and farmer.

F. C. COOKE

Science and Practice in the Manuring of Rice

By Dr. H. Glander. Green Bulletin Information about Manuring No. 6. Pp. 27. Verlagsgesellschaft für Ackerbau m.b.H. Hannover. Sophienstrasse 1. 1957.

The purpose of this booklet is to advance the claims of potash fertilising in rice growing. To achieve his object, the author has stated all that may be said in favour of potash and also given some conflicting evidence.

Dr. Glander contrasts the average yields in a number of countries with yields obtained on experimental stations in these regions. Thus he shows that great scope exists for better fertilising and cultural methods. Rice soils in a number of countries are compared, chemical and mechanical analyses stated and the amount of nutrients removed by the crop quoted by reference to research work. This brings out the importance of potash to the plant as well as its physiological effect on the crop. However, the writer omits reference to the supply of nutrients carried in irrigation water. Den Berger, for instance, concluded that in Java sufficient supplies of potash are carried to the crop in this manner.

The subsequent sections are devoted to the yield-increasing power of potash fertilisers in a number of countries, as exemplified by experiments, and the influence of potash fertilisers on disease resistance. Final sections discuss the absorption of potash by rice and the symptoms of potash deficiency.

It is contended that so long as yields are kept low by general nutrient deficiency, or are limited by another growth factor, characteristic symptoms of potash deficiency do not occur. With a low level of all nutrients the addition of a single nutrient often upsets the state of equilibrium and reduces other growth factors to such a low relative value that yields are depressed. In fertilising, therefore, all the nutrients must be taken into consideration and potash must take its place in the fertilising programme. It is conceded that the mutual relationship of fertilisers depends mostly on local conditions and the physiological requirements of individual rice varieties.

Dr. Glander has succeeded in writing a very concise and interesting treatise on rice production with special reference to potash. Many readers will not agree with all his conclusions, but that is to be expected. Potash is less generally required on rice soils than are nitrogen and phosphates, probably because these soils are usually of a heavy nature and contain adequate quantities of this element. On light soils, however, potash frequently gives an increased yield, while there is abundant evidence that potash alone is often ineffective, whereas when applied with nitrogen and phosphates it may produce heavier crops.

D. H. GRIST

Lexique Pedologique

By G. Plaisance. Centre de Documentation Universitaire, Paris. 1958. Pp. 357. Price not stated. In French, German and English.

Dictionnaire des Sols

By G. Plaisance and A. Cailleux. La Maison Rustique, Paris. 1958. Pp. 604. Price 7,500 fr. In French.

The publication of these two solid reference works on soils within a few months of each other is significant. Pedology – the science of soils – is a relatively young science, yet one of vital importance to agriculturists throughout the world. Likewise, it is an international science in which a considerable amount of research is being done in a large number of countries – new terms are being coined in many languages, while definitions and translated definitions often lag far behind.

Therefore these two books are, in a sense, complementary, the *Trilingual Dictionary* giving straight translations of approximately 3,300 terms for each of the three languages, and the *Dictionary of Soils* giving definitions in French for a vast number of words dealing with pedology and related sciences.

In the *Trilingual Dictionary* there are 248 pages of terms arranged alphabetically under the French language, the English and German equivalents being given alongside. Where exact equivalents do not exist in any of the three languages approximate terms are given in brackets. There are separate English and German indexes, and an 'international' one, containing such words as 'wadi', 'gley' 'rendzina'. In appendices there are classification schemes of 20 soil characteristics, such as degrees of slope and stoniness, horizons, particle size, drainage etc. A list of Latin and Greek prefixes and suffixes and a list of common pedological abbreviations are also attached.

The handsomely produced *Dictionary of Soils* deals with each word by the generally recognised method, indicating the kind of word (noun, adjective etc.), pronunciation, etymology, definition, example (where possible) and derivatives. It covers scientific words in pedology and related subjects, such as hydrology and erosion, and includes very many foreign-introduced words, particularly Russian. A table of English and American equivalents for metric units is appended.

W. LINNARD

Chemical Engineering Data Book

By D. C. Freshwater and T. K. Ross. Pp. 1,200, with many diagrams, charts and graphs. London. Leonard Hill (Books) Ltd. 1958. 84*s*.

With the increasing mechanisation of agriculture and the increasing use of agricultural chemicals, not only manufacturers, but also users of their products will from time to time require information on the theory of processing agricultural products and data for application to the solution of practical problems.

One of the most pressing problems today is the need to match materials of construction to the nature of, and the conditions of application of chemical sprays and dusts; or there may be problems in crop drying, the measurement and flow of water, problems of transporting agricultural supplies and produce; extraction of essential oils; heat and evaporation; fuels and power; air conditioning; water cooling and drying; crushing; grinding and mixing; filtration and so on.

All these subjects are covered in this useful compendium of information, which will undoubtedly fulfil the need for a guide to the solution of chemical engineering problems in agriculture and its auxiliary industries. It will naturally have its greatest appeal to chemical engineers, chemists, engineers, and those engaged in research on the handling and processing of agricultural products.

F. C. COOKE

United Nations

Agricultural Mechanisation – Effects of Farm Mechanisation on Horse Numbers. Pp. 58, with diagrams. Geneva, Switzerland. 1958. $0.40, 3*s*., or Sw. fr. 1.50.

The most remarkable feature which the study brings out is the steep decline in horse numbers which has taken place in recent years in North-Western Europe, and which appears to be continuing uninterruptedly. Although considerable differences exist in the rate of decline from country to country, the region as a whole now has only some 60% of its pre-war numbers of horses. Since about 1950, when the pace of mechanisation began to increase most rapidly, horse numbers in North-West Europe have fallen by about a third. In the U.K., where the average size of land holdings has allowed the mechanisation of agriculture to go further and spread wider than in any other Western European country, horse numbers in 1957 were about a fifth of their pre-war levels, and had fallen by about 60% since 1950 alone.

Output, Expenses and Income of Agriculture in some European Countries. Pp. 210. Geneva, Switzerland. 1958. $1.50, 11*s*., or Sw. fr. 6.50.

The composition of output (crops and livestock products) has remained stable, in value terms, in 17 European countries, mostly situated in Western Europe. During the period 1952 to 1955 receipts in 13 of those countries increased by 13%, mainly because of the higher volume of output; expenses increased by 21%, and the net income of agriculture increased by 10%. This represents a modest increase in real terms – about 2% per year.

The relative share of wages of hired workers in the net income of agriculture remains steady on the whole, although it varies considerably from country to country. An absolute increase in total labour costs has occurred in most countries because higher earnings per man have more than offset the decline in the number of hired workers.

The State of Rural Electrification in Europe in 1956. Pp. 43. Geneva, Switzerland. 1958. $0.30, 2*s*., or Sw. fr. 1.25.

With the growing demand for power, commercial electricity undertakings gradually came to build large power stations, which were often at some distance from the consumption centres, and to establish networks linking them. This naturally focused attention on the possibilities of extending the network to some small rural communities and isolated farms. Unfortunately, the prospective revenue from such consumers was not commensurate with the capital outlay required to supply them and governments, mindful of the social aspect of the problem and sometimes impelled by the threat of a flight from the land, have in most countries been forced to intervene.

Machinery and Equipment

Rough Riding in Comfort

The new *Austin* ' Gipsy ' 4-wheel drive, general-purpose vehicle is the first ever produced with independent, trailing-arm, rubber suspension on all four wheels. These unique suspension units employ a precompressed rubber cylinder, which is chemically bonded to a tubular steel housing and to an axial shaft on the end of which is mounted the trailing arm, carrying the wheel. All deflections of the arm, resulting from road irregularities, are absorbed by the torsional resistance (or ' twisting ') of the rubber. Other advantages are comfortable riding under rough conditions; a high degree of road noise absorption; no maintenance or lubrication required; and the efficiency of the suspension units is unaffected by sand, grit and climatic temperature changes.

There is a choice of a petrol or a diesel power unit, the engine capacity in each case being 2.2 litres. Power output from the petrol engine is 62 b.h.p. at 4,100 r.p.m., and from the diesel engine it is 55 b.h.p. at 3,500 r.p.m. The maximum drawbar pull is 3,000 lb. (1,361 kg.).

The four-speed gearbox has synchromesh on 2nd, 3rd and top, while an auxiliary gearbox provides a complete set of lower ratios and drive to all four wheels. Overall forward ratios are: Normal (rear drive only): 5.12, 7.02, 12.04 and 20.75 to 1. Low (4-wheel drive only): 10.35, 14.18, 24.32 and 41.92 to 1. There is provision for p.t.-o. to be fitted at the rear, or centre, of the vehicle.

The steel body has been coated in a rust-inhibiting compound, ensuring all-weather protection – inside and out – and there is a heavy undershield to protect the 13-gal. petrol tank from damage. The driving cabin accommodates three people on a bench seat with three individually cushioned seats. The cargo compartment will provide accommodation for a further six people – an important asset on farms and plantations and for survey teams and colonisation projects. The body has a cargo capacity of 23½ cu. ft. and, being of steel construction, will stand up to hard wear and tear. The cargo space at floor level is 55 in. long, but the steel tailboard can be completely removed or held horizontally by chains to give an effective deck length of 76 in. The maximum gross weight is 2 tons.

A ' Gipsy ' cross-country vehicle in deep mud and slush

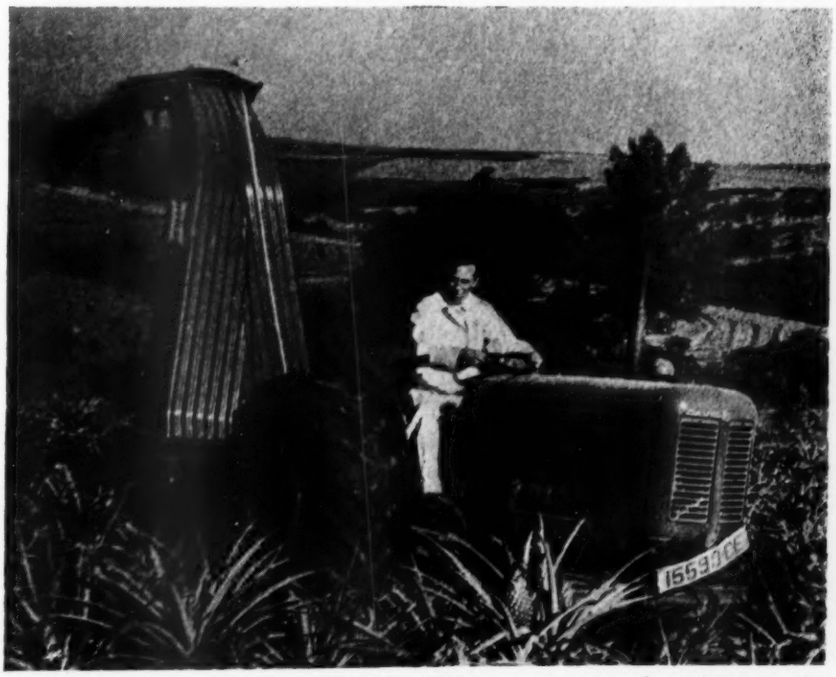
The ' Gipsy ' in its standard form is equipped with detachable side screens and the windscreen can be folded flat for working convenience. In adverse weather or hot sun it is possible to roll up both side and rear curtains and still have overhead cover. Conversely, in fine weather it is also possible to drive with a completely open cab, the roof cover dropping behind the driver and passengers.

Summing up, this is a comfortable, go-anywhere, power-packed vehicle, capable of a multitude of duties in agriculture and forestry.

Crop Destruction

After three or four crops have been harvested from a field of pineapples the area must be replanted. Hitherto the eradication of the old plants has been a laborious business, taking from six to eight months – a period known as the inter-cycle period. The old ' stand ' – yellow, withered and overcrowded with secondary and tertiary plants, and weeds – was ' knocked down ' by a serrated, multiple-disk harrow drawn by a crawler tractor. The broken plants were left on the surface to wither and die off before they could safely be incorporated into the soil. The wilted trash was subsequently ploughed in with a multiple-disk plough and harrowed repeatedly until the soil was thoroughly churned and broken up, and the trash uniformly incorporated into the top 12 to 15 in.

As a result of experiments carried out in Cape Province, one of the principal pineapple areas in South Africa, it has been found that the eradication



A ' Hurricane ' harvester, drawn by a David Brown 900 tractor, knocking down old pineapple plants at Amalgamated Pineries, Cape Province, South Africa

The ' Workobus ' is a 12-seater vehicle designed for hard wear and tear

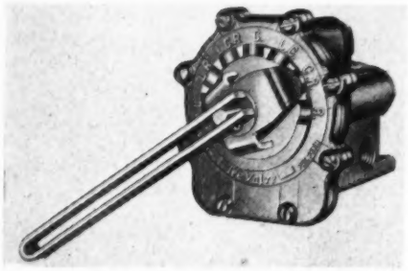
of the old ' stand ' can be carried out more efficiently, more cheaply and far more quickly by using a flail-type forage harvester drawn by a standard wheeled tractor.

The combination actually used was a ' Hurricane ' forage harvester and a *David Brown* ' 900 ' tractor. Two ' cuts ' were taken – one with the cutter drum set at about 10 in. high, and the second with it set slightly above ground level. The finely-chopped and pulverised stems and leaves are blown out through the chute and spread evenly over the ground.

This treatment is so effective that the trash takes only two to three weeks to die off instead of from six to eight months by the old method.

Control Valve for Boom Sprayers

The Spraying Systems Co. of the U.S.A. have announced their new TeeValve for accurate control of spraying, when a boom sprayer is used. The valve has a large lever handle and its seven indexed settings permit control of spraying with left, centre, or right boom sections or any combinations of these three sections. Selection of position is made with the lever down, and the valve is shut while in this position. Once the selection has been made, the valve opens as soon as the lever handle is raised. As a result, chemicals are saved, while the selection is being made. Each position of the valve is indicated, and the setting is locked in the chosen position and cannot drift, through shock or vibration.



The new ' TeeValve ' manufactured by Spraying Systems Co. for the accurate control of spraying with a boom sprayer

The TeeValve may be mounted within easy reach of the driver's seat and the large lever handle is easily grasped and operated, even when gloves are worn. Thus there is easy and accurate control with maximum convenience to the operator, while the most economical use of chemicals is assured.

The valve is made in either aluminium or stainless steel and so can be used with practically all standard farm chemicals. Construction features include positive poppet valves and stainless steel valve springs. Nylon valve seats can be replaced easily merely by removing the outlet adaptors.

The Massey-Ferguson silage forager discharging into a trailer attached at the rear of the machine

Bus for Labourers

The ' Workobus ' 12-seater is a *Martin Walker* conversion of the *Austin* A152 ' Omnivan '. Intended primarily for use as a crew bus for rough usage under hard working conditions, it is a multi-purpose vehicle for carrying workers and their tools and equipment to the scene of operations, *e.g.* tea plucking, paddy harvesting, jungle clearing, drain cutting, forestry work etc.

The driver and front passenger have individually upholstered seats, and in the rear compartment there are two fixed bench-type seats of slatted wood construction, seating five aside. There is a door in the nearside and also a rear doorway, with a folding step at each entrance. A roof ventilator of the extraction type is fitted.

Flying Stones

Simms Motor Units Ltd. are manufacturers of motor accessories, such as magnetos and other electrical equipment; they are now also producing a range of flexible couplings for fuel injection and the exhauster drive. Of direct interest to those engaged in earth moving and levelling, and wherever the roads are covered in loose stones, are their robust, rustproof and weatherproof ' Stoneguard ' motor vehicle lamps, as, owing to the nature of the work, they need proper protection when working at night.

One-man Forager

When shown for the first time at the National Silage Demonstration, the *Massey-Ferguson* '725' forager attracted tremendous interest. This is a one-man forage harvester which can be attached to and powered by either the ' 35 ' or ' 65 ' Massey-Ferguson tractor, using a unique hitch giving instantaneous coupling, without ' spot on ' backing. It is a mower with a floating cutter bar, giving a constant

level of cut over undulations. A helical paddle sweeps the cut grass from the mower blades to the impeller fan and the air blast carries it on to the delivery chutes, which are of two types – for rear or for side delivery.

Sparking Plugs

Those of our readers who are in the habit of fitting and forgetting their sparking plugs will be interested in the results of trials carried out by a member of our staff who recently replaced an apparently sound set of plugs in his car.

Car, Morris Minor; fuel, Shell with I.C.A.; plugs, Champion N.5; mileage, over 18,000; all plugs firing.

Acceleration tests

0 to 30 m.p.h. in first gear: Old plugs, $8\frac{3}{5}$ sec.; new plugs, $6\frac{2}{5}$ sec.

0 to 50 m.p.h. through the gears: Old plugs, 19 sec.; new plugs, $16\frac{4}{5}$ sec.

As a result of the change, the car was more responsive and much livelier and obviously the petrol consumption would be reduced because of the more efficient ignition. This, then, confirms the advice of the manufacturers that plugs should be replaced every 10,000 miles, even though they may appear superficially to be sound.

Champion sparking plugs are of many types to suit every type of engine and they are fitted to the vast majority of tractors, farm vehicles and estate cars. They were used on the standard Ferguson tractors of Sir Edmund Hillary's Antarctic Expedition at –90°F. (*vide* WORLD CROPS, 1958, **10,** 283).

The new 18-in. 'Hayterette' can deal easily with the roughest overgrowth and the finest lawns

For Lawns and Orchards

A new *Hayter* mower, the 18-in. 'Hayterette', has ample power and is of sufficiently robust construction to deal equally with the roughest overgrowth and the finest lawns; it will also operate in wet or in fine weather without any possibility of choking, and it chops as it cuts, thus making it unnecessary to collect grass cuttings. Its *Villiers* 7F 98-c.c. engine gives easy starting and 12,000 cuts per minute from four cutter blades secured to a revolving bottom plate – the result is a neat cut with a superb finish.

Planting Out

A general note on the 'Jeep' 4-wheel drive, cross-country vehicle, produced by *Willys Motors Inc.*, was given in WORLD CROPS, 1958, **10,** 343. All its four wheels can be made to exert driving force because all are 'live', the front axle being driven by a drive shaft and differential in the same manner as the rear axle.

The 4-wheel drive is provided to give additional traction in difficult conditions – on ice, in heavy sand, and in mud and snow. It will also give low-speed pulling power to get heavily-loaded trailers moving or when drawing agricultural implements, but it should only be used when greater traction is required than is available through the lowest gear.

Four-wheel drive should not be used for normal driving over dry, hard-surfaced roads – the additional tractive effort it provides is not needed then and, of course, the rate of travel is too slow. For normal running the front axle drive is disengaged and the vehicle is thus converted to 2-wheel drive.

There are also three p.t.-o. positions for use when stationary power is required; thus it can be used with a variety of implements. One such is the post-hole borer, which can not only be used for the obvious purpose of preparing holes for fence posts, but also for preparing planting holes for fruit trees, as described in WORLD CROPS, 1958, **10,** 440.

A simple yet powerful post-hole borer operated from the rear p.t.-o. of the 'Jeep'

Six Speeds Forward and Reverse

International Harvester Export Co. has announced the introduction of a new 134-h.p. diesel crawler tractor designated as the International TD-20, which represents a major advance in design in its power class with a six-speed, full-reverse transmission.

The TD-20 has speeds ranging from 1.5 to 7 m.p.h. in forward range and from 1.8 to 8.4 m.p.h. in reverse. This model has a maximum drawbar pull of 27,500 lb. in first gear at 1.5 m.p.h.

The new John Deere 440 I.C. crawler tractor is powered by a 35-h.p. Perkins diesel engine

An outstanding feature of the tractor is the six-speed, full-reverse transmission, which provides operators with a single-lever control which can be used to shift into any of the six speeds.

A direction-control lever which can be operated with a sweep-of-the-arm motion makes it simple and easy to move the tractor in either forward or reverse gear in any of the six speeds. The high reverse speeds of up to 8.4 m.p.h. will certainly increase its speed of operation.

A Powerful Light Tractor

A powerful riding tractor with a 6.6 h.p. Kohler engine is now available from Bolens Products Division of the *Food Machinery and Chemical Corporation, U.S.A.* The engine provides ample power for the tractor and a range of attachments.

The special feature of the new Model 21 Super RIDE-a-matic is the exclusive Versa-Matic no-clutch drive, which gives forward speeds up to 5.5 m.p.h. and up to 4.5 m.p.h. in reverse, without shifting, clutching, or stopping, and with the engine running at a constant speed. Its dimensions and specifications are as follows : Wheel base, 40 in.; height, 36 in.; width, 30½ in.; maximum length, 60 in.; crop clearance, 9 in., and a turning circle of 5 ft. The capacity of the fuel tank is sufficient for up to 4 hours normal operation; there is a snap-type front hitch and a trigger-type rear hitch which requires neither pins nor bolts and has a lock that holds rear-mounted attachments tight or permits them to ' float '. The front wheels are fitted with 400—8 tyres and the rear wheels with 600—12 tyres and the latter have band-type brakes. Its shipping weight with the tyre fluid removed is 450 lb. The following implements and attachments are available for use with this tractor: 30-in. front-mounted twin-blade rotary mower, 3-gang mowers, 6½-in. and 8-in. moldboard plough, cultivator frame, 8-blade disk harrow, sickle-bar mower, combination snow plough and grader blade, lawn roller, 30-in. reel-type mower, utility cart and circular saw unit.

Reader Service

For further information on any item reviewed in this issue please write to:

Reader Service,
WORLD CROPS,
Leonard Hill House,
Eden Street, London, N.W.1,
England

A New Crawler Tractor

The new *John Deere* 440 I.C. crawler tractor is powered by a 35-h.p. Perkins diesel engine and has been specially designed for heavy-duty agricultural work, for land clearance and forestry operations.

The Caterpillar

It is not generally known that the *Caterpillar Tractor Co.* made the world's first successful tractor in America over 50 years ago. They now have eight large plants in the U.S.A. and also factories in Australia, Brazil and England, and recently they opened a large factory in Scotland for making tractors and engines to supply the sterling area.

This will be the largest source of such equipment outside America. The vast production floor has a spread of 600,000 sq. ft., and the 65-acre site leaves room for expansion. A remarkable feature is the extent to which mechanical power has been substituted for muscle power. Thus, while the executive offices are a hive of industry, the production floor, in startling contrast, is a place of seeming inactivity. This is making tractors the modern way – with streamlined production and labour-saving devices the job can be made to look easy.

The product which is being manufactured here is the D8 Caterpillar, the second largest of a range of powerful machines designed to take the load off men's backs, and complete earth-moving operations rapidly which in bygone times required many years of work from thousands of slaves, or were never finished at all.

The Bolens Model 21 tractor, which has a no-clutch drive

Agricultural Chemicals

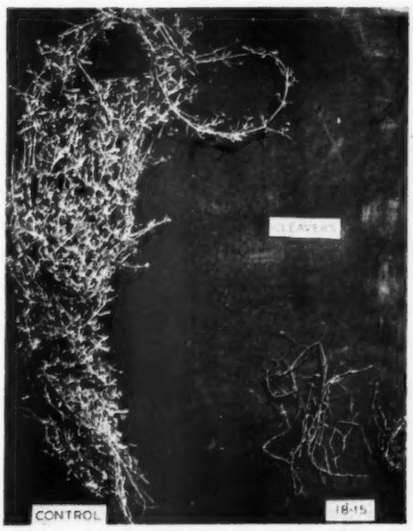
Cleavers meets its Waterloo in 18-15

Compound Weedkiller

In WORLD CROPS, 1958, **10**, 144, an account was given of the evolution of a new weedkiller, *Fisons* 18-15, which then appeared to give the answer to the growing menace of cleavers, *Galium aparine*, in cereals. However, one can never be certain that the results of trials in one year are reproducible in another year, when weather conditions may be different.

During its second year of trial the new formulation has been tested in over a thousand trial plots, totalling well over 100,000 acres, and the results have confirmed the conclusions of the previous three years' large-scale trials and experiments.

The product contains two active ingredients – the hormone weedkillers MCPA and 2,3,6-TBA, the latter representing a new departure in belonging to an entirely new group which acts differently from the phenoxy hormone weedkillers. It penetrates into the leaves more rapidly; it is very resistant to breakdown in the plant; it is effective on those weeds which are resistant to the others and, conversely, it is least effective on those weeds which are controlled by the others. It works best under poor growing conditions and in very cold weather.



What 18-15 *does to cleavers. Cleaver plants taken from the treated and untreated plots* 10 *weeks after spraying*

Thus the two together provide an ideal combination for a formulation which will control the widest possible range of weeds under a wide range of conditions.

The latest advice for this product is to spray early – before the early jointing stage in cereals. This will ensure maximum crop safety and maximum yield response, because the crop will be growing in cleaner conditions. If a farmer disregards this recommendation and sprays late, he is likely to find a number of sterile ears, and in wet seasons a blackening of the ears, due to the attacks of certain fungi.

Experiments carried out in Belgium, Holland, Sweden, Denmark, Switzerland, Germany, East Africa and Japan all confirm that 18-15 can effectively control twelve of the most pernicious weeds in cereal crops – with the exception of coltsfoot. Apart from this, there are a number of weeds, not found in Britain, which are resistant to most other herbicides, but can be dealt with by the new formulation.

Invasion by cleavers. Left: *unsprayed;* right: *sprayed. This picture was taken* 10 *weeks after spraying*

Compost Concentrate

A 2-lb. bag of 'CO-FU-NA' farmyard manure substitute – a *Chase* product – is the equivalent of 56 lb. of farmyard manure, according to the manufacturers. If this is correct, then the objection to the use of *bulky* organic manures has been met. Furthermore, the product is a clean, dry, sweet-smelling friable powder which is simple and easy to apply.

Cornfield, in his contribution to the Annual Report on the Progress of Applied Chemistry, 1957 (just published), states: 'The importance of increasing, or even maintaining, the organic matter (humus or carbon) content of soils can hardly be overstressed'.

This new compost concentrate is not only a 'living' organic manure with a high bacterial content, but it is also an absorbent material which holds water like a sponge and imparts it slowly with the contained plant foods to the growing plants.

Nor is its use prohibitive on grounds of cost, as a 2-lb. bag, costing 3*s.* 9*d.*, is sufficient to treat 90 sq. ft. of lawn. The method of application is to spread it over the surface of the loose soil and rake it in before sowing the seed. In the case of established lawns it is sprinkled lightly over the grass and then scratched over and rolled in.

Virus Yellows

This, the most serious disease of sugar-beet in Britain, owes its name to the characteristic yellowing of the outer leaves of the plant; in the worst years the crop may be reduced to half, depending on the date of the infection. The financial loss to the industry has been computed as being between £1 and £2 million per annum, equivalent to about £6 per acre.

The most important vector or carrier of the virus of the disease is the green aphis, *Myzus persicae*, otherwise known as the peach potato aphid, but it is also spread by the black bean aphid, *Aphis fabae*, a single insect being capable of moving from plant to plant and spreading the infection over a wide area.

During a mild winter these insects persist in large numbers on their chief host plants, the brassicas, and also on turnips and mangolds in clamps; in more severe winters the aphid is more dependent for its survival on the eggs laid on trees of the Prunus family, in enclosed gardens, and other sheltered places. They hatch out and become very active as winged insects in May and June, when they are to be found on sugar-beet plants, where they will produce a further generation in July if left to do so, as summer warmth favours rapid multiplication.

It is therefore essential to inspect sugar-beet fields regularly from May onwards, and, as soon as the aphids of either of the two types of insect appears, to apply control measures at once.

By spraying the crop with 'Megatox' – a new systemic insecticide – a very high 'kill' can be achieved within 24 hours of the application, according to the manufacturers, *Associated Fumigators Ltd.* It penetrates rapidly into the plant tissues through the leaves and roots, and remains effective as an insecticide for up to about 28 days, and thus the crop is protected during the first period of activity. A further application may be necessary later in the season, if a further severe infestation of winged aphids threatens.

The new formulation contains fluoracetamide, which is claimed to be the most active aphicide yet discovered, without the disadvantages of the related compound, sodium fluoracetate, which is a very dangerous poison indeed. It is an approved insecticide in that it is not considered that there is any hazard to consumers of the refined sugar, the derived molasses, the sugar-beet pulp or the tops of the plants. It will also appeal to spraying contractors in that it is not unpleasant to use and is not an organo-phosphorus compound, so that blood tests will not be necessary (see WORLD CROPS, 1958, **10**, 49).

Photo: Shell

Using a fogging machine to spread an insecticidal dust into dense jungle on an island near Singapore

Reader Service

For further information on any item reviewed in this issue please write to:

Reader Service
WORLD CROPS,
Leonard Hill House,
Eden Street, London, N.W.1,
England

Protection Against Malaria

Two and a half million people, mainly children, still die each year from malaria. The total world population exposed to malaria is over 600 million; eradication has been achieved in nine countries with a total population of 231 million and is well advanced in seven others with a total of 43 million people. In another 44 countries, inhabited by 302 million, malaria destruction has only started, and in 16 more with a population of 500 million eradication is being planned.

Certain species of mosquitoes are the carriers of the disease. The mosquito transmits it by feeding on an infected human and carrying a microscopic parasite gorged with the blood to the next victim it bites.

Malaria is not only a direct killer; it also induces death from other causes: for instance, pneumonia; it stunts physical and mental development; lowers agricultural productivity; bars entry to many potentially fertile areas of the world; and stricken countries cannot attain normal social and economic progress.

While defence concentrates mainly on curing the victims and ensuring that the disease is suppressed, the attack is carried to the known locations of the mosquitoes to destroy them either at their source or before they can spread the disease. This is largely a chemical warfare, employing synthetic substances that kill the fully-grown insect as it wings its way from house to house, or the larvae breeding in streams and stagnant water.

The oil industry has a long-standing interest in the fight against the mosquito, dating back to the late 19th century, when oils were first used to kill mosquito larvae. Oil larvicides are still employed, but of greater importance are the more modern synthetic insecticides, products of the ever-growing petroleum chemical industry, which kill mosquitoes with certainty and economy. An ounce or less of insecticide will destroy all larvae throughout an acre of water; a fraction of a pound sprayed on to the interior walls of a house provides protection which will persist for many months.

World Crop Reports

Increased Cocoa and Sugar Beet Production

INTERNATIONAL REPORT

Cocoa Beans

The first (October) estimate of the total world production of cocoa beans for the 1958–59 season is 1,898 million lb. (847,000 long tons) or 9% above the 1957–58 estimate.

Weather, which drastically reduced output in Africa during 1957–58, is reported to have been more favourable for the current crop and increased output is expected this year. North American and Asian production during 1958–59 is expected to remain at about the same levels as in the preceding two years.

North America

Cocoa bean production in North America during 1958-59 is estimated at 181 million lb., practically the same as the 179.6 million lb. now estimated for the 1957–58 crop.

The estimate for *Costa Rica* of 20 million lb. is 1 million lb. above the revised 1957–58 estimate. The trees reportedly are in good condition for the October–December harvest.

Cuba is expected to produce about 6 million lb. of cocoa beans, compared with 5.1 million lb. in 1957–58. Dry weather and unrest in Oriente province are the chief reasons for the smaller 1957–58 output.

The estimate for the *Dominican Republic*, the largest North American producer, is 75 million lb., 3 million lb. less than in 1957–58.

In *Grenada* recovery of the cocoa trees from the hurricane was impeded by dry weather in mid-1957 and production during that crop year was about 4 million lb. It is believed that this total will increase to about 5 million lb. during 1958–59.

South America

Total production in South America for 1958–59 is estimated at 489 million lb., compared with 527 million lb. in 1957–58. Production in all countries except Brazil is expected to be about the same as in the preceding year. *Brazilian* production may decline somewhat from the high levels of the past two years. Prospects for the main crop (October–April) are very good, with output probably about the same as in 1957–58.

Ecuador's production is expected to continue the trend upward with a modest increase during 1958–59. No significant increases are expected during 1958–59 from the remaining countries in this area.

Africa

African production of cocoa beans during 1958–59 is estimated at about 1.2 billion lb. This is 184 million lb. above last year's small harvest and is 63% of total estimated world production. More favourable weather so far this growing season is expected to result in increased output during 1958–59 from the major producing countries of this area.

Cocoa bean production in *Ghana* during 1958–59 is estimated at 545 million lb. Weather during the first six months of 1958 is reported to have been favourable, and prospects for a good crop were better at the end of July 1958 than at the end of July 1956, when a bumper crop was in the making.

Production of the beans in *Nigeria* should be greater than in 1957–58. The first estimate for this country is 258 million lb. Favourable weather and increased use of chemical sprays should aid production. The *Cameroon* production of cocoa should continue to increase, and the first estimate for the current crop is 150 million lb. Additional trees reaching bearing age and increased use of chemical sprays to control insects are the principal reasons for the expected increase.

Production in *French West Africa* is estimated at 130 million lb. This is somewhat lower than expected as the result of dry weather. No great increases from the 1957–58 level are expected during 1958-59 for the other countries of Africa.

Asia and Oceania

Total production of cocoa beans in Asia and Oceania during 1958-59 is estimated at 35 million lb. This is 2.5 million lb. above the revised 1957–58 figure. The rise is accounted for by expected increases in production in the *Philippines*, *New Hebrides*, *New Guinea* and *Western Samoa*.

Sugar-beet

World sugar-beet production during the 1958–59 season is estimated at 153.5 million short tons, compared with 145.5 million tons in 1957–58. The increase is due to a further expansion of acreage in many countries, from reported increased sugar production in mainland China, and from favourable growing conditions. Although yields are lower than last year, they are higher than average yields in the 1950–51 through 1954–55 period and the 1956–57 season. Total harvested acreage in 1958–59 is placed at 14.9 million, which is 9% higher than the 1957–58 acreage of 13.6 million.

Sugar-beet production in *North America* during 1958–59 is expected to be 16.3 million tons. This is 279,000 tons less than last season.

The *U.S.* beet crop suffered from unfavourable growing conditions early in the season. However, the conditions improved in August and September and the yield is now expected to be 16.9 tons per acre. While this is lower than last season's yield of 17.7, it is higher than earlier forecasts.

In *Canada* the beet production is officially forecast at 1,257,000 tons, 19.2% above last year's crop of 1,054,000 tons. Most of Canada, especially the large beet area, has been favoured by good growing weather.

The 1958-59 beet crop for all *Europe* is forecast at 83.5 million tons, while the last season's crop is now placed at 79.8 million tons. Western European production is expected to increase 5.6% and Eastern European 2.6% above last year. In most years since the end of the war the majority of countries in Europe have increased their acreage.

Each of the *West European* beet-growing countries participating in the Common Market (Belgium, France, West Germany, Italy and Netherlands) raised both acreage and production. Acreage increased from 2,328,000 in 1957–58 to 2,593,000 in 1958–59, an

11.4% rise. Estimated production is expected to be 38 million tons this season, compared to 36 million tons last year. There were other important increases in Spain, the U.K. and Austria. Spain's acreage is placed at 445,000, with estimated beet production of 3.7 million tons; U.K. acreage of 414,000 is expected to yield 5.5 million tons; and Austria's production is placed at 2 million tons from 117,000 acres.

Countries in *Eastern Europe* increased their acreage during 1958–59, except in Yugoslavia and Bulgaria. Poland increased its acreage by 45,000, but is expected to produce only about the same beet crop as last year, as weather conditions were unfavourable during most of the growing season.

This year the sown acreage in *U.S.S.R.* is officially stated to be 5.9 million, compared with 5.3 million last season. The estimated total beet crops from these acreages were 48.5 million tons and 43.5 million respectively. The beets processed for sugar were 46 million and 42 million tons. This year's crop may well be a record.

Most other countries are increasing their acreage and production. *Turkey* planned an increase in sown acreage, but floods, heavy rains, snow and frost during the early part of the season reduced the harvested acreage to 354,000, 3.3% below the 1957–58 acreage of 366,000. However, the yield is expected to be a little higher than last year because of dry weather late in the summer. The beet production now is estimated at 2,480,000 tons, or 48,000 tons more than last year.

Chile introduced sugar-beet cultivation in the early 1950s. The acreage and production have steadily increased ever since. The 1957–58 crop was 212,000 short tons from 21,000 acres. The 1958-59 crop may increase to 250,000 tons from 25,000 acres.

Indications are that *mainland China's* beet acreage will be the largest ever claimed. Although little is known about the area planted in previous years, it is evident the trend is upward. The estimate for the 1958–59 crop is 3 million tons of beet from 445,000 acres.

Israel, *Lebanon*, *Azores*, *Albania*, *Afghanistan* and *Algeria* are producing some beets for sugar. This industry, especially in Israel, is expected to grow in order to reduce sugar imports. *Argentina* hopes soon to produce sugar-beets in the Buenos Aires province.

REGIONAL REPORTS

France

The 1958 crop of *tobacco* in France is placed at about 132 million lb. – 6% less than the 1957 harvest. Crop conditions are reported as generally good, although cold weather and storms probably will make the harvest several weeks later than usual. Light air-cured types make up all but about 2% of the 1958 crop, with the remainder dark air-cured.

The 1958 crop of *prunes* in France has been forecast at 26,000 short tons, fresh basis. This is about the same as was harvested last year, when an estimated 7,800 tons of dried prunes were produced.

Japan

The 1958 *tobacco* crop in Japan is estimated at 294.3 million lb., nearly 9% below the 1957 crop. This was a planned decrease, since certain types were in over-supply. All types except Burley and native light air-cured tobacco were allotted smaller acreages in 1958 than in 1957. Burley acreage was increased 25% because of greater export and domestic demand for this type.

Burma

Burma's 1957–58 *cotton* crop of 55,000 bales (each 500 lb. gross) was 27% below the 75,000 bales produced in 1956–57. Production has declined steadily since 1954–55, when the crop reached a post-war record of 117,000 bales.

The downward trend in recent years is attributed to an acreage decline—from 540,000 in 1954–55 to 297,000 in 1957–58—and to drought, especially at planting time. None of Burma's cotton is irrigated. The 1958–59 crop, most of which was planted by the end of July, suffered from lack of rain early in the season, but as plantings were increased to 335,000 acres production may be somewhat above 1957–58.

Burma's cotton exports in 1957–58 dropped to an estimated 35,000 bales, or 44% below the 62,000 bales exported in the previous season.

England and Wales

Mild and cloudy weather with rain in all parts of the country, followed by mainly dry weather, sunny periods and lower temperatures, occurred during the first half of November. In the second half of the month the weather was mainly cloudy, with widespread mist or fog.

Although good progress had been made during the month in all areas except on heavy soils, autumn cultivations were relatively less forward than usual in most parts of the country. Some progress was made with sowing, particularly on lighter lands, where satisfactory seedbeds were generally obtained. Seedbeds on heavy soils were poor in many districts.

Early-sown *wheat* had germinated satisfactorily, but growth of later-sown crops was slow in some areas and slug damage was reported from many districts. *Barley* had germinated well and slug damage was slight. *Oats* looked well on the whole, but some slug damage was reported. *Mixed corn* was satisfactory. *Rye* had germinated well and looked promising. *Beans for stock-feeding* were mostly sown much later than usual; those sown earlier were satisfactory.

The lifting of *potatoes* was almost complete; wet conditions caused difficulty in harvesting on heavy land. On the whole, the proportion of tubers affected by blight was not high, but varied from district to district and was more serious in coloured varieties. Tubers in clamps and stores appeared to be in satisfactory condition in most areas.

The harvesting of *sugar-beet* proceeded well, although wet conditions caused difficulties in some areas; roots generally were in good condition. *Mangolds* were lifted only with difficulty in many areas; on the whole, roots were large and healthy. *Turnips* and *swedes* grew well and were a satisfactory crop, although some soft rot was reported. On the whole, *kale* crops were good, but were backward and stunted in some areas, due mainly to the wet conditions.

Pastures continued to provide feed during the month and, on the whole, less winter fodder was used than usual. It was expected that on lowland farms the supply of winter keep would be adequate. On many upland farms supplies would not be sufficient.

Acknowledgement is made to *For. Crops & Mark.* and to *Spec. Reg. Inform Services* for much of the information contained in the above reports.